THE COMBAT CRITERION IN NAVAL AVIATION

by

JOHN G. JENKINS

and

the Staff of the Aviation Psychology Branch,
Division of Aviation Medicine, Bureau of
Medicine and Surgery, United States Navy

with the cooperation of

E. S. Ewart
NRC Committee on Aviation Psychology

and

J. B. Carroll
Harvard University

This report, on research conducted by the Aviation Psychology Branch, was prepared under the auspices of the National Research Council Committee on Aviation Psychology, under Task Order IX, Contract No. N7onr-291, with funds provided by the Division of Aviation Medicine, Bureau of Medicine and Surgery, United States Navy, through the Office of Naval Research.

January 1950

DIVISION OF AVIATION MEDICINE
BUREAU OF MEDICINE AND SURGERY
UNITED STATES NAVY
NRC Committee on Aviation Psychology Report No. 6
Washington, D. C.

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National Research Council

Committee on Aviation Psychology

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1950

LETTER OF TRANSMITTAL

NATIONAL RESEARCH COUNCIL

2101 Constitution Avenue, Washington, D. C.
Division of Anthropology and Psychology

Committee on Aviation Psychology

January 12, 1950

Chief, Bureau of Medicine and Surgery
Navy Department
Washington 25, D. C.

Attention: Code 5

Dear Sir:

The attached report, entitled The Combat Criterion in Naval Aviation, represents a technical presentation of purposes, methods, and results of the Combat Criterion Program carried out by the Division of Aviation Medicine, Bureau of Medicine and Research, United States Navy. This program was developed and carried through, during the war years, by the Aviation Psychology Branch under the leadership of the late Captain John G. Jenkins, H(S), USNR.

By reason of the death of Captain Jenkins and the separation of professional personnel from the service, the analysis of data accumulated in the research program was not completed. It was, therefore, requested that the National Research Council Committee on Aviation Psychology complete the analysis of the data and prepare a report on the Combat Criterion Program. This work was done under the terms of a contract between the Office of Naval Research and the National Research Council, with funds provided by the Division of Aviation Medicine, Bureau of Medicine and Surgery, U. S. Navy.

The report presents the findings of one of the few comprehensive studies of the problem of combat proficiency undertaken during World War II. The findings have important implications for the measurement and prediction of combat effectiveness of military personnel.

Cordially yours,

M. S. Viteles

Morris S. Viteles, Chairman
Committee on Aviation Psychology
National Research Council

MSV:maf

EDITORIAL FOREWORD

The Aviation Psychology Branch, Division of Aviation Medicine, Bureau of Medicine and Surgery, United States Navy, has reported studies on the prediction of success in Naval aviation training.[1] In these studies it was emphasized that the prediction of success in training may well have no bearing on the prediction of success in combat flying. The Branch early recognized that efforts should be made to develop predictors of success in combat and operational flying, but the war had been in progress two years before a research program directed towards this end could be organized.

The development of what came to be known as the Combat Criterion Program was the work of the late Captain (then Commander) John G. Jenkins, H(S),USNR, who served as head of the Aviation Psychology Branch during most of the war years. Captain Jenkins early recognized the importance of directing research towards the prediction of combat proficiency. He not only showed great foresight in recognizing the significance of the problem, but exhibited considerable ingenuity in formulating the approach to the collection of combat criterion data. In addition to planning the necessary research, Captain Jenkins was responsible for implementing the program, in part through exploratory work conducted by him during a tour of duty in the Pacific theatre of war operations.

Many members of the staff of the Aviation Psychology Branch participated in the collection of the combat criterion data. Moreover, extended analysis of the data was made by Captain Jenkins and his associates. However, the untimely death of Captain Jenkins, combined with the fact that with the end of the war many of the professional and technical staff members were separated from the Service, made it impossible to complete the analysis and prepare a final report. As a result the Bureau of Medicine and Surgery, United States Navy, requested that the National Research Council Committee on Aviation Psychology undertake compilation of the data, completion of certain of the analyses, and preparation of a report on the Combat Criterion Program. The work was conducted under the terms of a contract between the Office of Naval Research and the National Research Council, with funds provided by the Bureau of Medicine and Surgery.

This report embodies a technical presentation of the Combat Criterion Research Program, detailing the purposes, methods, and results of this program in a manner which it is hoped will provide the professionally trained individual with source and background material basic to further work on the problem. In the final chapter is found a detailed summary of the entire research program, followed by a discussion of the implications of the program, and suggestions for future research. Brief summaries have also been incorporated at the end of each chapter. Moreover, an effort has been made, in so far as possible, to render each chapter "self sufficient" in that concise reviews of pertinent material from other chapters have been presented so that the discussion in

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[1]A general survey of this selection program is given in Fiske, Donald W. Validation of Naval aviation selection tests against training criteria. Jour. of appl. Psychol., 31, 6, December 1947, pp. 601-614.

individual chapters may be followed without the necessity of reading carefully all of the preceding chapters. While this procedure results in a measure of redundancy, it has been followed as an aid to readers who may be interested in covering thoroughly only the material in certain chapters.

This report is, of course, the product of the cooperative effort of many individuals. In addition to Captain Jenkins, who played a major role in the development of the program, acknowledgment should be given to all officers and civilian personnel attached to the Aviation Psychology Branch, Division of Aviation Medicine, who were associated with the program. Of particular importance was the contribution of the four officers who collected nomination data in the Pacific Ocean Area, viz: Lt. Chester C. Bennett, Lt. Comdr. Verne W. Lyon, Lt. John W. Macmillan, and Lt. William McGehee. (Ranks as of the time of the collection of data). The technical notes, memoranda, and analyses prepared by personnel associated with the Division of Aviation Medicine, Bureau of Medicine and Surgery, were extremely useful in the preparation of this report. The first three chapters of the report were adapted, in large part, from one prepared by J. B. Carroll. The discussion of intensive analysis of data from 10 selected air groups (in Chapters IV and VI) was taken from another report prepared by Dr. Carroll.

Preparation of the final report was primarily the responsibility of E. S. Ewart, Technical Aide, NRC Committee on Aviation Psychology. Additional statistical analyses were conducted by Dr. Carroll, who completed and interpreted the factor analyses begun by C. J. Boulger of the Aviation Psychology Branch; by D. Bakan, who completed certain of the analyses presented in Chapter VI; and by the staff of the Committee on Aviation Psychology, which conducted a large number of supplementary analyses in order to render more definitive certain of the statistical treatments. Particular acknowledgment should be made to Dr. Carroll, who served in the Aviation Psychology Branch during the war, for his services in assembling the raw data, in consulting on the organization and content of the report itself, and in reviewing and criticizing the drafts of each chapter. In spite of the participation of these and others, both the Combat Criterion Program and this final report represent the outcomes of research directed by Captain Jenkins and stand as a memento to a psychologist who in a short span of life made important contributions to the science of psychology and to its useful application.

M. S. Viteles, Chairman
Committee on Aviation Psychology

January 12, 1950

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SUMMARY[1]

The primary purpose of the combat criterion program was the development of a criterion of combat effectiveness against which selection tests could be validated. It was recognized, of course, that such research would also have many other practical and theoretical implications. The procedure which proved of greatest utility in the collection of combat criterion data was the "nomination technique." This technique involved eliciting from Naval aviators with combat experience "nominations" as "Highs" of two men on whom they would be glad to fly wing; and as "Lows" of two men they would not want flying wing on them. Provision was also made for indicating reason for nomination.

Specific details of the procedure evolved from work of H-V(S) psychologists both in the Aviation Psychology Branch in Washington and in the field. Preliminary collection of data and a survey of large-scale data-collection possibilities was made by the late Captain (then Commander) J. G. Jenkins during a tour of duty for this purpose in the Pacific Ocean Area early in 1944.

On the basis of this exploratory work a preliminary field investigation was initiated, during which data on 1793 cases were obtained from respondents, some of them in the States, rather than in combat areas. Nominations were obtained through individual interviews, and reason for nomination data were of the free-response type. Analyses of these preliminary data resulted in: (1) establishment of 33 categories in terms of which the free-response reason-for-nomination data could be classified; (2) determination of (a) frequency of use of categories as reasons for nomination, and (b) the judged importance of behavior represented by the various categories; (3) research on "clustering" of categories into superordinate classification on the basis of rational considerations, by combat pilots and by psychologists; and (4) preliminary research on prediction of the combat criterion by means of tests in the selection battery.

These data collected in the preliminary investigation were considered somewhat inadequate since, for example, not all of the nominations had been collected through use of identical procedures; some of the cases had been collected stateside; and the number of subjects for whom selection test data could be located was too small to make possible definitive analyses relative to the prediction of the combat criterion. Therefore steps were taken in the fall of 1944 to obtain data on a larger number of subjects in the combat areas.

Data on 4325 pilots (2274 "High," 1829 "Low," and 222 "Mixed" cases) were obtained from 2872 respondents by four H-V(S) officers who were assigned to tours of duty in the Pacific Ocean Area. Group administration techniques

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[1] A somewhat more detailed recapitulation and summary of the combat criterion research is presented in the first section of Chapter VIII of this report, pp. 235-241.

were employed, reason for nomination information being obtained through use of checklists. The checklist for Highs contained 22 items or "reasons for nomination." The checklist for Lows contained 26 items. Respondents indicated which reasons for nomination they considered applicable.

Intensive analysis of data from this large-scale investigation was carried out. Following are certain of the outstanding findings:

1. A relationship between nomination status and rank was evident, a rather large proportion of High nominees being Senior officers, a rather large proportion of Low nominees being Junior officers. This relationship may have resulted in part from the phraseology used in the questions employed to elicit nominations.

2. A number of considerations indicated that the nominations were reliable, one estimate of reliability being represented by a coefficient of .80.

3. Analysis of reason for nomination data indicated little relationship between frequency of use of reasons for nomination for High and for Low, respectively, and little relationship between frequency of use and judged importance of reasons for nomination. Explanations of these lacks of relationships are considered.

4. As might be expected, individual reasons for nomination did not appear markedly reliable, although more reliable in connection with Low than with High nomination. These findings suggested the desirability of treating reason for nomination data in terms of "clusters" of reasons, or "reason syndromes," in future research.

5. Certain differences in frequency of use of reasons for nomination appeared with respect to rank and specialty. Some of these were of considerable interest, as for example the fact that the reason "avoids or evades going on combat missions" ranked nineteenth in terms of frequency of use with respect to Junior officers, but seventh with respect to Senior officers.

6. (a) Factor analyses of the intercorrelations among reasons for nomination data provided important insights into the probable structure of combat effectiveness, and moreover provided a framework in terms of which test development and validation, and further criterion research, can be carried out.

   (b) The factor analyses of reason for nomination data yielded eight interpretable factors with reference to both High and Low data. Factors designated

Sociability, Practical Intelligence, Coolheadedness, Conscientiousness, Combat Aggressiveness, Skill in Flying, and Teamwork appeared on both analyses.[2] One factor, designated Leadership, appeared only in the High analysis. Another factor, designated Reaction to Failure, appeared only in the low analysis.

(c) Second order factor analyses of the matrices of intercorrelations among High, and among Low primary factors, respectively, suggested superordinate classifications in terms of which the behavior of High and Low pilots could be described. Two High second order factors were isolated, designated respectively Fighting Ability and Capacity for Combat Leadership. Three Low second order factors were apparent, designated, respectively Emotional Inadequacy, the Fear-Impulsively Foolhardy Vector (a bi-polar factor), and Lack of Practical Intelligence. The two High second order factors, and particularly the three Low second order factors, were almost completely orthogonal, i.e., uncorrelated. The isolation of these relatively uncorrelated superordinate "traits" is of considerable practical and theoretical importance.

7. None of the selection tests designed to predict success in training functioned effectively in predicting the combat criterion, particularly when rank, as an extraneous factor was controlled. Some promise was shown, however, for a special "combat key" for the Biographical Inventory.

It was concluded that the nomination data have a great deal of "authoritative validity" in view of the life and death nature of the situations in terms of which the nominations were made. The relationship between nomination status and rank might be considered evidence against the validity of the data. However, this relationship could be explained, in large part, as a function of the phraseology of the questions used to elicit nominations, and, moreover, some degree of rank-nomination status relationship might well be expected. These facts, together with other evidence including the somewhat desultory, but none-the-less impressive, data in terms of such "outside" criteria as were available, warrants the conclusion that the criterion data on nomination status as a High or Low, yielded by the nomination technique, can reasonably be considered valid.

Implications for future research are discussed, and basic elements of a program for continued research on the combat criterion problem outlined. In particular, details of a program of test development and validation, and of a program of criterion research, are considered.

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[2]These designations are, of course, those given to the High factors. The comparable Low factors were given converse designations.

CHAPTER I

BACKGROUND AND EARLY EXPLORATORY STUDIES

Administrative Setting. The interest of the Aviation Psychology Branch in obtaining combat criterion data grew out of its basic mission: to develop tests and procedures for the selection of aviation cadets to be given training leading to their designation as Naval Aviators. It was realized that the tests and procedures developed for this purpose, primarily with reference to success in training, would not necessarily tend to pick men who were successful in the final criterion of success -- good performance in combat areas. It was therefore felt urgently necessary to develop a criterion of success in combat and to validate the selection tests against such a criterion.

Whether it would be possible to obtain suitable evaluations of combat performance was not known, nor was it possible to answer this question without a considerable amount of preliminary exploration. The investigators felt that before attempting to set up a combat criterion they should have reliable information as to the elements of success in combat flying. In other words, a kind of "job analysis" of combat flying was required.

The first contact made by APB representatives with fleet activities to obtain material on combat performance was that made by Lt. R. T. Ross, who had been sent to the Pacific early in 1943 in connection with other duties. While in the Pacific, he completed a number of interviews with combat-returned pilots, asking them such questions as:

> "If you were the Senior Member of a Selection Board and you had 50 men all physically qualified in front of you and you could only pick 30 for training, what would you look for?
>
> "If you were in charge of the training program, what changes would you make, and what things would you emphasize?
>
> "If you were going to organize a flight, what men whom you know would you ask for, and which leave behind?"

As a result of such interviews, a small number of names of "good" and "poor" pilots were returned, together with several remarks about combat performance. To quote from one of Ross' letters:[1]

> "A fighter pilot is not necessarily a 'hot pilot.' A VF man may not...fly with elegant precision but still be a good VF man. The essence of VF flying is teamwork.... The only salvation is to fly two or four plane formations and to stick

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[1]Lt. Comdr. Ross' letter to ChBuMed (APS) dated March 1, 1943.

together. Each pilot must have perfect confidence in the others. Leaders have no time to see if their wing man is where he ought to be. If he isn't there, they both get shot down....

"If this analysis is correct, then a high correlation between 'success in training' and 'success in combat' is not to be expected. Washing out cadets for inability to shoot circles would appear to be a mistake. They may be excellent combat men, even if they are not precision flyers."

A file of names of "good" and "poor" combat pilots was thus initiated as far back as March 1943. Additional names, obtained in somewhat the same manner as indicated above, were forwarded to APB by an H-V(S) representative, stationed at the Returned Pilots' Board in San Diego. It was early seen that "the collection of combat criterion data would be a slow process at best. When ratings are in, it is acutely necessary to have the fullest possible comments in order to make any progress at sorting out influences of purely personal dislikes, etc. Mere listing of names will never be enough."[2]

In July 1943, the Bureau of Aeronautics requested the APB to initiate studies which would lead to improved methods of classifying Naval Aviators for specialized training. The letter in which this request was made is shown in Appendix 1-A.[3] Such a study made it imperative for the Branch to develop information on the elements making for success in the various aviation specialities; it became possible, furthermore, to develop large files of names of "good" and "poor" pilots with official sanction.

Preliminary Exploration. To this end, on 15 Sept. 1943 three H-V(S) officers were assigned to collect materials at fleet and operational training commands as follows: (See Appendix 1-A.)[3]

Lt. Jesse T. Fontaine.......CNAOT, Jacksonville
Lt. Martin D. Kaplon........ComFairWest Coast, San Diego
Lt. Frederick A. Webster....ComAirLant, Norfolk

Before these men were sent to their stations, agreement was reached in the APB that efforts should be concentrated on getting names for the upper and lower tails of the distribution of pilots in various specialties, rather than to obtain ratings on all pilots in specified groups. Furthermore, it was decided that the name of each nominee should be accompanied by a statement of the reasons why he was successful or unsuccessful in his specialty. In this way, it was hoped that composite pictures of the good and the poor pilots in various specialties could be constructed. The officers were also instructed to work independently on the search for valid criteria of success in operational training and in combat, and to conduct

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[2]Ltr. from Comdr. J. G. Jenkins to R. T. Ross, April 20, 1943.

[3]BuAer ltr. Aer-Tr-2-MHA/P11-1/OV4/MV1.

general interviews designed to elicit the pilots' opinions of the traits important in the different types of flying.

The most useful outcome of this phase of the work was a file of 1818 cases of pilots judged "good" or "poor," either in operational training or in combat. In addition, descriptive free-response statements about some cases became available.

Within the limits of circumstances, the three officers also found occasion to make certain ancillary studies. Lt. Fontaine, for example, was especially concerned with the search for valid criteria of success in operational training. Among the criteria which were investigated were:

Ratings by Squadron Commanders
Ratings by instructors
Success in field carrier landing practice
Torpedo tactics practice
Training records.

None of these criteria appeared to have sufficient usefulness to justify further study,[4] with the result that the APB was left with the basic criterion afforded by the "nomination technique," whereby individual pilots were asked to name several pilots who were outstandingly successful and several who were outstandingly poor.

One officer, Lt. Webster, attempted to obtain lists of traits generally assumed to be important in various specialties. The difficulties with this approach are aptly summarized in Aviation Psychology Technical Memorandum No. 4:

> "One approach consisted in asking returned combat pilots what characteristics were important in meeting combat requirements in VF, VP, etc. On a priori grounds, this method promised to yield little more than a series of stereotypes; limited runs with the method seemed to confirm this assumption. While no quantitative series were ever run, it was noted that fighter pilots readily constructed a stereotype for 'Big Boat' men which proved acceptable to other VF pilots but not to the VP pilots.[5] The converse was also true. It was further noted that, when a "scrambled" list of alleged VF and VP characteristics was presented, respondents employed about equal numbers of supposed VF and VP traits in describing either a fighter pilot or a 'Big Boat" pilot. Because of such outcomes -- and also

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[4]The shortcomings of these criteria in operational training resulted from the fact that the Squadron Commanders frequently were not familiar with the performance of the pilots rated, because of the high turnover in instructor personnel, and other factors.

[5]"VF" denotes fighter pilots; "VP," patrol or "Big Boat" pilots.

because the method would yield no names of specific pilots for validation of predictors -- it was discarded in favor of attempting to build an inductive picture of the several pilot specialties through the accumulation of individual descriptions of specific pilots known to the respondents."

As a matter of historical interest, a summary of statements obtained by Lt. Webster is shown in Appendix 1-B.

Several minor studies based on materials from this phase of the combat criterion project were completed. One involved the comparison of the selection test scores of 450 "high passers" and 150 washouts in operational training. The names were submitted by Lt. Fontaine. The results for the cases for whom test scores could be found are shown in Table 1.1. Application of the chi-square technique shows that the distributions of scores for passers and failers are significantly independent (at the 1% level) for each of the three tests. The passers tended to make higher scores on the tests than the failers.

<u>Analysis of Flight Jackets</u>. Another preliminary study involved the analysis of the primary and intermediate flight jackets of 88 Naval Aviators who had been rated as outstandingly well adapted or poorly adapted to carrier flying on the basis of their performance in combat. The group was composed of 44 "Highs" and 44 "Lows." The results, which are summarized in Tables 1.2, 1.3, 1.4, and 1.5, show that the unsuccessful pilots, as compared to the successful ones,

1. had received more low grades on the various flight maneuvers in primary training (especially landings, wing-overs, pylons, take-offs, and emergencies);

2. had been given more down checks in primary training; and

3. made lower average grades in the specialized phase of inter-mediate training.

<u>Disadvantage of Collecting Data Stateside.</u> It was frequently emphasized in the reports of the three men at field stations that the collection of combat criterion data within the continental limits had a number of disadvantages. First, it was difficult to secure men who had had a considerable amount of combat experience, and there was no assurance that the men who were secured were a representative sample of those in the combat areas. In point of fact, there was some likelihood that groups of pilots returning from the combat area at that time (late 1943) might be overloaded with the less successful men. Also, there was a question whether the responses of returned pilots in the continental limits were as valid as those which might have been obtained in the forward areas. Furthermore, it was felt that the job-analysis data on combat performance could only be obtained by first-hand observation in areas of combat operations. Consequently, it was decided to send a representative of the APB directly into the forward areas to develop an adequate methodology and rationale for obtaining combat criteria. Pending the return of this representative, the studies conducted by Lts. Fontaine, Webster, and Kaplon were suspended

TABLE 1.1

DISTRIBUTIONS OF LETTER GRADES ON THE TESTS OF HIGH
PASSERS AND FAILURES IN OPERATIONAL TRAINING

(Letter Grades Based upon Definitions used Prior to 1-1-43)

Cases*

	Biographical Inventory				Mechanical Comprehension Test				Personnel Test			
	Passers		Failures		Passers		Failures		Passers		Failures	
Letter Grade	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
A	63	15.9	12	9.2	22	5.4	0	0.0	8	2.3	1	0.9
B	181	42.2	47	36.2	88	21.8	19	13.8	54	15.4	7	6.2
C	141	32.9	47	36.2	266	65.8	86	67.2	259	74.0	89	78.8
D	36	8.4	20	15.4	27	6.7	23	18.0	23	6.6	11	9.7
E	3	0.7	4	3.1	1	1.0	0	0.0	6	1.7	5	4.4
Total	429	100	130	100	404	100	128	100	350	100	113	100

*High Passers--450 cases rated "High" by instructors in operational training--names submitted by Lt. J. T. Fontaine

Failures-------first 150 washouts in operational training--list secured from training records NAS, Jacksonville

(Two groups began training at approximately same time)

Application of the chi-square technique shows that the differences between distributions of passers and failures are significant at the 1% level on each of the three tests. Passers on the tests make higher scores than failures do.

TABLE 1.2

DISTRIBUTIONS OF TRAINING GRADES OF 88 CARRIER PILOTS RATED OUTSTANDINGLY SUCCESSFUL OR UNSUCCESSFUL IN COMBAT

(Frequency of Grades below 2.8 on Check and Instructional Flights)*

Maneuvers in Primary Training

	Number of Grades below 2.8	
	0-29	30 or more
44 cases rated high	34 (77.3%)	10 (22.7%)
44 cases rated low	22 (50.0%)	22 (50.0%)

*The tabulations are based upon an average of 28 check and instructional flights for the Lows and 26 check and instructional flights for the Highs.

About twice as many low as high cases received 30 or more grades below 2.8 on the various maneuvers in primary training. The probability is only 8 in a thousand that differences as great as this would occur by chance alone. Results similar to those in the table were obtained for instructional and check flights alone and for grades below 2.5 in both check and instructional flights.

TABLE 1.3

DISTRIBUTIONS OF TRAINING GRADES OF 88 CARRIER PILOTS RATED OUTSTANDINGLY SUCCESSFUL OR UNSUCCESSFUL IN COMBAT

(Frequency of Down Checks in Primary Training)

	Number of Down Checks		
	0	1-2	3 or more
44 cases rated high	18	17	9
44 cases rated low	4	19	21

About twice as many lows as highs received three or more down checks; the probability is less than one in a thousand that differences as great as this could be attributed to chance alone.

TABLE 1.4

DISTRIBUTIONS OF TRAINING GRADES OF 88 CARRIER PILOTS RATED OUTSTANDINGLY SUCCESSFUL OR UNSUCCESSFUL IN COMBAT

(Final Average Flight Grade in Primary Training)

	Number of Cases Receiving Various Grades	
	3.0 or more	2.9 or less
48 cases rated high	27	21
45 cases rated low	13	32

The chances are fewer than one in a hundred that differences as great as this would result from chance alone.

TABLE 1.5

DISTRIBUTIONS OF TRAINING GRADES OF 88 CARRIER PILOTS RATED OUTSTANDINGLY SUCCESSFUL OR UNSUCCESSFUL IN COMBAT

(Final Average Flight Grade in Intermediate Training)

	Number of Cases Receiving Various Grades	
	3.0 or more	2.9 or less
48 cases rated high	19	29
45 cases rated low	7	38

The probability is one in a hundred that differences as great as this would result from chance alone.

<u>Field Exploration of Methods by Comdr. Jenkins* in the POA.</u> The Chief of DivAvMed was able to enlist the support of DCNO(Air) in making provisions to send a representative outside the continental limits for the specified purpose of investigating at first hand available ways of obtaining combat criterion data. This representative, Comdr. J. G. Jenkins, H(S) USNR, arrived in Pearl Harbor and reported to the staff of ComAirPac at the end of January 1944. After studying two air groups that were temporarily based in the Islands, he was assigned to the carrier <u>LEXINGTON</u>, where he remained on duty for the next six weeks. The selection of the time was fortunate in that it permitted him to follow his intensive investigation of <u>Air Group 16</u> on this carrier through certain leisurely periods and through strikes at Mili, Palau, and Woleai. Following his detachment from this ship, he was given an opportunity to recheck his methods with a "Big Boat" squadron at an advanced base in the Pacific Area. He completed his studies and returned to Washington in May 1944.

The exploration of methods for obtaining combat criterion data was approached first by trying out and refining the nomination technique which had already been used by Lts. Webster, Fontaine, and Kaplon in their studies of returned pilots. It should be emphasized that the nomination technique at this state involved individual interviews with pilots. A group technique, in which an assembled group of pilots was asked to make their nomination in writing, had not been used at all up to the time of Comdr. Jenkins's visit to the Pacific. Since it was obvious that criterion lists could be built up only with great difficulty on the basis of individual interviews, one part of Comdr. Jenkins's mission was to investigate the feasibility of a group technique.

Perhaps the most important part of Comdr. Jenkins's mission in the Pacific was the attempt to define the combat criterion in terms acceptable to the pilots and meaningful in the pilots' frame of reference. In practice, this requirement was translated into the problem of the form of the question which the pilots should be asked in making their nominations. It was realized that the pilots could not be asked simply to name "good" and "poor" combat flyers, since those adjectives might refer to different things in the minds of different pilots. One pilot might be thinking of flying ability <u>per se</u>, while another would make his nominations in terms of box score against the enemy. As a result of discussions with Squadron Commanders, flight surgeons and the pilots themselves, it was decided to ask the respondents to name:

1. Two men, living or dead, known to the respondent, on whom he would be glad to fly wing if assigned to another Air Group. (For convenience, these men were labeled as "Highs.")

2. Two men, living or dead, whom he would not wish to have flying wing on him, if assigned to a new Air Group. ("Lows").[6,7]

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*Later Capt. Jenkins.

[6]This technique, and variations of the procedure, was designated the "nomination technique."

[7]It should be noted that officers nominated High represented men whom

Thus, the combat criterion was defined in terms of the pilots' acceptance or lack of acceptance of other pilots when forced to make a choice of teammates in a hypothetical new Air Group. It will be noted that the phraseology of the questions referred to carrier flying; though it was realized that this would have to be modified before application in other types of flying, the general structure of the questions was to cause some difficulty in later use of the technique. In the case of P-boat pilots, it seemed logical at that time to ask the men to name aviators whom they would like or not like to have as co-pilots. It was later found that the relationship of the pilot to his co-pilot in a patrol plane was quite different from the relationship of the pilot to a wingman in formation flying, and that further modification of the form of question was necessary. Moreover, the lack of direct comparability in the definitions of High and Low nominees was to prove somewhat unfortunate.

The nomination technique as used by the APB had always involved, in one form or another, the eliciting of specific comments about men nominated. There were several reasons for this. First, it was believed that combat nominees could possibly be grouped according to the reasons for their acceptance or non-acceptance. This might be true especially in the case of the Lows, since a Low might be acceptable in all but one or two respects, but a man might not in general be nominated for High unless he were acceptable in all traits making for success. Secondly, it was planned if necessary to eliminate from consideration men who were nominated on the basis of purely personal likes and dislikes or for other reasons not relevant to the combat performance of the man. (Actually, it was never found necessary to exclude cases in this way.) Third, it was desired to get a full and frank expression of the respondents' opinions, undisturbed by any checklist or set of categories which had been developed in an office. In the early stages of research of this kind it has usually been advisable to get free-response material in the field before coding and refining the data.

It developed that the pilots were in general quite willing to give free-response descriptions of their four nominees. In fact, the descriptions of the Lows were sometimes startlingly blunt. Comdr. Jenkins gained the impression that the interviews conducted outside the continental limits elicited more frank and open replies than those conducted stateside -- an impression confirmed by later investigators and in discussions with the pilots themselves. This bluntness seemed not to be limited to the interview situation; the pilots were equally frank in expressing their opinions of each other in the ready-room. These observations supported the contention that criterion data should be obtained in combat areas.

The interviews with individual pilots lasted anywhere from a half-hour to four hours, depending in part on the verbal facility of the respondent. There was rarely if ever any unwillingness to cooperate in the project, but

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7(Continued) the respondent would be glad to have as <u>superiors</u>, whereas officers nominated Low represented men whom the respondent would not wish to have as <u>subordinates</u>. This lack of comparability in definitions of High and Low subjects was introduced in an attempt to obtain as much as possible differentiation between the two criterion groups. The assumption was that a person designated as unsatisfactory as a subordinate would probably be "lower" than a person designated unsatisfactory as a superior.

some pilots were found to be less able than others to express their opinions in detail. Wherever possible, the pilots were asked to give specific instances of behavior representing good and poor performance. In general, they were able to do so, although some respondents were able to go no further than such statements as "He's a lousy flyer," or "He's a good leader, and that's all I can say about it."[8]

Application of the formalized individual nominating technique in the squadrons studied by Cdr. Jenkins yielded a fair-sized list of names of Highs and Lows. These lists, when returned to the APB in Washington and combined with lists being obtained concurrently from other sources, made it possible for the APB to make the first large-scale runs of the data against test predictors. The results of these studies will be treated in Chapter II.

Aside from the tryout of the individual nominating technique made possible by this preliminary work, there were related problems for study. One was the development of a group nominating technique whereby materials could be collected faster than with the individual technique. It was found that with a slight modification of procedure, it was possible to secure criterion data from a group of pilots assembled together in a ready-room or other convenient places, and that materials so secured had the appearance of being as valid as those obtained by the individual nominating technique. Half of the pilots in VB-16[9] were individually interviewed, while the other half were administered the group nominating technique.

<u>Study of VB-16</u>. Another problem concerned the validity of the individual nominating technique in terms of other methods of evaluating combat performance. An intensive series of cross-checks were carried out in VB-16, one of the component squadrons of Air Group 16 on the LEXINGTON. The VB squadron was chosen because of the fact that one type of criterion, nominations of pilots by rear seat gunners, was available there and not in the VF squadron. The following ratings, in addition to those by pilots, were obtained for VB-16:

1. Nominations of two Highs and two Lows by enlisted aircrewmen.

2. Ratings by the squadron commander on the following scale:

   "A" -- outstanding, definitely above average
   "B" -- average, satisfactory
   "C" -- below average, but useful to squadron
   "X" -- should be dropped from squadron

3. Selections of several "best" and "worst" men in the squadron by the air group commander.

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[8] On his first tour in the POA, Comdr. Jenkins summarized on a single card, the comments from several respondents concerning a specific individual. Although this procedure at the time appeared to have certain advantages it was not followed in subsequent work since individual responses provided more useful information.

[9] "VB" denotes dive bomber.

4. Selections of several "best" and "worst" men in the squadron by the flight surgeon. (Actually, the flight surgeon selected no men for the "worst" group.)

Table 1.6 summarizes the data obtained by these methods and shows the relationship of each series of ratings to the nominations obtained from the pilots themselves. All the relationships are significant at the 7% level or better. The best relationship in terms of a contingency coefficient was obtained for the ratings made by the squadron commander. It may be concluded that the technique involving nominations by pilots gives results which are sufficiently similar to those yielded by other techniques to justify using it in practice, as the sole criterion.[10] As contrasted with other techniques, the nomination technique has the distinct advantage that it involves judgments of pilots by their peers. It is possible, of course, that a more reliable and predictable criterion could have been constructed by combining the nominating technique with the other types of rating methods which were studied, but evidence on this point has not been obtained since it would have been necessary to use the other methods on a large scale.

Other Outcomes. During the period of temporary duty in the POA, Cdr. Jenkins was able to make numerous observations on such matters as:

1. Factors making for squadron morale.
2. The job of the combat pilot (especially in carrier aviation).
3. The role of leadership in combat squadrons.
4. Factors contributing to "combat fatigue" and "war weariness."
5. Personality patterns of successful and unsuccessful pilots.

These observations will not be summarized here since the primary concern of this report is with the objective findings which derive from the combat criterion itself.

His tour of duty afforded Comdr. Jenkins an opportunity to survey many of the routine details which would condition any further collection of data in the combat area. For example:

1. The problem of securing acceptance of the investigator in a squadron in the combat area.

2. The problem of security (forwarding of confidential reports, method of identifying nominees, etc.).

3. Transportation problems.

The experience thus obtained was to prove valuable in formulating plans for sending four AFB representatives to the combat area later in the year.

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[10] While ratings by squadron commanders on combat performance appeared to be relatively consistent, the nominating technique appeared to be more reliable on the basis of authoritative considerations, e.g., based on more respondents, etc.

TABLE 1.6

RELATIONSHIP BETWEEN DIFFERENT APPRAISALS OF PILOTS' COMBAT EFFECTIVENESS (VB-16)

(Nominations from other Pilots Obtained by Formalized Nominating Technique)

a. Nominations by Aircrewmen vs. Nominations by Other Pilots.

		Nomination by Aircrewmen			
		Low	Not Nominated	High	Total
Nomination by other pilots	High	1	3	8	12
	Not Nominated	4	13	7	24
	Low	3	2	0	5
	Total	8	18	15	41

Chi-square significant at approximately .02 level.

Contingency coefficient (C) = .47

b. Ratings by Squadron Commander vs. Nominations by other Pilots.

		Ratings--Squadron Commander				
		X	C	B	A	Total
Nomination by other pilots	High	0	1	2	9	12
	Not Nominated	0	3	13	8	24
	Low	2	1	1	1	5
	Total	2	5	16	18	41

Chi-square significant at level less than .01.

Contingency coefficient (C) = .63

"A" denotes outstanding, definitely above average; "B," average, satisfactory; "C," below average, but useful to squadron; "X," should be dropped from squadron.

TABLE 1.6 (Continued)

c. Selections of Air Group Commander vs. Nominations by other Pilots

Nomination by other pilots	Selections--Air Group Commander: Low	Not Selected	High	Total
High	0	3	9	12
Not Nominated	3	14	7	24
Low	1	3	1	5
Total	4	20	17	41

Chi-square significant at approximately .07 level.

Contingency coefficient (C) = .42

d. Selections of Flight Surgeon vs. Nominations by other Pilots

Nomination by other pilots	Selections--Flight Surgeon: Not Selected	High	Total
High	5	7	12
Not Nominated	19	5	24
Low	4	1	5
Total	28	13	41

Chi-square significant at approximately .07 level.

Contingency coefficient (C) = .35

It is of interest that Cdr. Jenkins had the opportunity to revisit Air Group 16 about a year later when it was in the process of re-forming. On this occasion the members of the former Air Group 16 were re-interviewed. The problems of the grouping of categories and the relationship of frequency and importance of categories were studied. The results of these studies will be treated in Chapter II.

CHAPTER II

PRELIMINARY FIELD INVESTIGATION INVOLVING 1793 COMBAT CASES

COLLECTION OF DATA, AND PROCEDURES

Collection of Data. With the return of Comdr. Jenkins from the Pacific it became possible to initiate the large-scale application of the techniques developed there and to begin the analysis of data. In addition to some 300 nominee-cases collected by Comdr. Jenkins, several hundred cases became available through the efforts of Comdr. A. C. Hohn, (MC) USN, who became interested in the project while stationed in the Marshall Islands. He was personally briefed by Comdr. Jenkins with regard to the basic instructions and procedures.

In the summer of 1944, instructions went out to Lts. Kaplon and Webster, then stationed at San Diego and Jacksonville, respectively, to resume their collection of combat criterion data, this time using the manual of procedures developed by Comdr. Jenkins. Their interviews were conducted with pilots recently returned from the combat areas. While it was realized that cases collected within the continental limits might not have the validity of those collected in the combat areas it was believed that the improvement in procedures would yield data sufficiently valid to justify preliminary analysis.

As cases were received from the field, they were processed in such a way that basic sorts and analyses could be made. Each nomination of each respondent was typed off on a keysort card. In order to keep faith with the respondents, no name appeared on the card, identification being carried only in the form of an assigned serial code number. The full statement of the respondent, giving the reasons for his nomination, was typed on the reverse side of the card. At the same time provision was made for securing data and keeping records on the full name, officer file number, birthdate, and other pertinent data for each nominee. At no point was information by name and by combat grouping ("High" or "Low") assembled on the same document. Considerable effort was necessary to bring together all nominations of a single individual, since this involved careful checking of the identity of each individual nominated from whatever source.

Both files -- the file containing the nominations themselves and the file containing the full identification of the nominees -- were eventually reproduced in the form of decks of IBM punched cards which could then be sorted and otherwise manipulated in a variety of ways. Before this could be done, however, the free-response statements given by the respondents had to be categorized and coded in a convenient form.

Coding of Free-response Material. A number of problems were faced by the APB. The raw data occurred in the form of descriptive statements made by one or more respondents for each pilot. (In some cases, the field investigator had summarized a number of respondents' statements in a single paragraph.) How could this mass of detail be reduced to a number of discrete categories? True, a number of descriptive phrases occurred in the

material over and over again -- phrases like "hot pilot," "dopes off," "undependable," "doesn't get the word," etc., but there were also frequent references to specific instances of behavior. It was necessary, therefore, to use scrupulous care in constructing the list of categories. At the outset, each member of the Branch was asked to inspect several hundred free-response statements and to submit a tentative list of categories.

At this time, the opinion was held that the categories should be fairly broad and few in number. Accordingly, several members of the Branch submitted lists containing anywhere from seven to ten categories. One member turned in four broad categories, but broke each category into a number of subcategories. It was not long before it was decided to aim for greater specificity, and several lists later submitted contained as many as 45 or 50 separate categories. Each list was then "cross-checked" on a different sample of statements by an officer other than the originator of the list. This process brought to light many ambiguities of definition, revealed new areas of category definition, and suggested different ways of aligning the categories. A tentative draft of a category-list was then drawn up and agreed upon by all hands. Pairs of officers were then assigned to code samples of responses independently; after the coding they discussed their differences and suggested further modifications of the code list. This procedure was repeated a number of times -- how many times history does not record. The goal was to construct a list of categories by means of which a high level of agreement could be secured by several officers coding the same set of data. But agreement among coders was not the only criterion: The series of definitions were to employ the language and the frames of reference of the respondents rather than those of the classifiers. Furthermore, the Branch wished to avoid loss of data through the forcing of heterogeneous entries into a single pigeon-hole. The definitions were to have the utmost "purity" short of unreasonable specificity. To quote from Aviation Psychology Technical Memorandum No. 4:

> "Since the primary function of our files of combat data is to serve as a validational medium for predictors, it was early agreed that, in coding, all judges would aim to maximize the <u>homogeneity</u> of entries in a category rather than to maximize the <u>population</u> in that category. In practice, this means that doubtful items are dropped out of coding. To put it otherwise, we have attempted to protect the purity of our categories rather than to obtain a more nearly complete description of each nominee. The reason for this will become apparent in the next paragraph.
>
> "Since the median nominee is described by approximately three different -- and more or less independent -- descriptive categories, the APT has further agreed that the unit of response for purposes of analysis is to be the descriptive category rather than the individual pilot. To make this specific, consider pilot Richard Roe. We find him described as unable to land aboard a carrier, as lacking knowledge of elementary navigation, and as

tending to 'blow up' under stress of combat. For the present, at least, no effort is made to locate the two or three other cards in our files which might present the same syndrome. Instead, Richard Roe becomes a unit in our analysis of all cases of men who lack basic flight skills. At the same time, his card is also sorted out when we are analyzing those who are incompetent at navigation. And his card comes up for a third time when sorts are being made for those who do not stand up under stress."

It is doubtful that the reader would wish to examine the numerous tentative lists which were prepared during this period. One rather extensive list is presented in Appendix 2-A. It will suffice to consider in detail the list finally agreed upon. This list was the basis for the final coding of the responses and, in turn, for the statistical analysis of the data in terms of categories. Though no exact counts have been made, it is estimated that after suitable indoctrination of a pair of coders their initial disagreements in coding were of the order of 10%.

The list of categories finally agreed upon (as of 9 October 1944) is presented as Appendix 2-B. It consists of 33 categories, four of which (#100-103) were placed in the "100" series because they appeared to have considerably more generality than the other 29. Some of the definitions are given only in the positive (P) or negative (N) sense, either because they did not seem to have clear opposites or because their opposites simply never appeared.

<u>Illustration of Coding</u>: An illustration of the application of the categories to a single paragraph statement, is represented by the statements given by one respondent who nominated case #2686 for "Low:"

> "A small, immature, selfish soul. When the going was tough, this officer did nothing but gripe and offer a minimum of cooperation and help. As a consequence some of the weaker pilots were tempted toward the same train of thought. I never want to serve with this officer again, particularly in combat. Incidentally, this lad is a good pilot."

The APB coded this case as follows: The first two sentences refer to category #102 (N). The phrase "when the going was tough" suggested category #7 (N). The third and fourth sentences were not coded, being considered irrelevant and general statements. The fifth sentence was coded by category #2 <u>in the positive sense</u>.

This same case was nominated for Low by two other respondents; however, another respondent nominated the man for the High group. His statement follows:

> "Was pleasant to fly on. He was steady, smooth, confident, and quick witted. You knew his decision would not be overdaring or foolish, and that he would stick by his wingman in trouble. This gave me confidence in him and in myself during attacks."

The statement was coded with the following categories, all in the positive sense: 3, 4, 6, 13, 23, 100, 101, 103. This case was selected for presentation here because it illustrates the various problems of coding. The case can hardly be called typical, however, since it was one of the relatively rare cases nominated for both the High and Low groups. The case was further atypical in that it was found necessary to use categories in opposite senses in coding a single statement. In at least 95% of the cases, statements given for Highs could be coded with positive categories throughout, and statements for Lows with negative categories throughout.

RESPONDENTS AND NOMINEES

Analysis of Results. It was decided to close the books on the returns obtained by the free-response technique as of 15 December 1944 in order to make a number of statistical analyses. Results were available from something over 800 respondent pilots who had completed at least one tour of combat duty. This number of respondents turned in considerably less than the 1600 High and 1600 Low names that might have been expected on the basis of four nominees per respondent. This is largely due to the fact that many pilots were named for one group or the other by more than one respondent. A further cause for reduced numbers was the occasional respondent who gave only one name (instead of the requested two) for the High or Low group. Actually, after the identity of each nominee had been checked as fully as possible, it was found that 1793 individuals had been nominated, distributed as follows:

885 HIGHs, 298 (33.7%) of whom were nominated by more than one respondent;

47 MIXED (nominated for both the high and low groups); and

861 LOWS, 237 (27.5%) of whom were nominated by more than one respondent.

Frequency of nomination among various specialties. In Tables 2.1 and 2.2 are presented breakdowns of the cases received in terms of the number of nominations and the distribution of cases among the various specialties. The data are separated for the cases in which the separate responses were summarized by the field investigator.[1]

The high reliability of the nomination technique in separating the Highs from the Lows is suggested, first, by the fact that in only 47 or 2.6% of the cases was there disagreement between different respondents who

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[1]As noted previously during his first tour in the POA, Cdr. Jenkins summarized the comments from several respondents concerning a specific individual on a single card. The entries under "Summary Responses" are taken from data collected in terms of this procedure.

TABLE 2.1

FREQUENCY OF NOMINATION AMONG VARIOUS SPECIALTIES — HIGH GROUP
PRELIMINARY FIELD INVESTIGATION
(N = 1793)

12-26-44, CLV

No. of Times Nomin.	No. of Individuals with Summary Responses: VF	VSB	VTB	VPB	VB	NC*	Total	No. of Indiv. with Single Entry Responses: VF	VSB	VTB	VPB	VB	NC	Total	GRAND TOTAL: No.	Per Cent
20		1					1								1	0.1
19																
18		1					1								1	0.1
17																
16		1					1								1	0.1
15			1		1		2								2	0.2
14		1		1			2								2	0.2
13	3						3								3	0.3
12			1				1								1	0.1
11		1		1	1		3								3	0.3
10	1	1	1				3								3	0.3
9	1	1		1			3	1						1	4	0.5
8	3		2				5								5	0.6
7	7	2	2	1			12								12	1.4
6	5	4	2	1	1		13		3					3	16	1.8
5	4	7	4	1			16	1	1	1	2			5	21	2.4
4	12	3	4		1		20	3	2	5				10	30	3.4
3	15	5	6	5	2		33	9	5	5	4	1		24	57	6.4
2	30	8	8	8	1	2	57	31	16	16	13	1	2	79	136	15.4
1								237	119	81	104	22	24	587	587	66.3
Total	81	36	31	19	7	2	176	282	146	108	123	24	26	709	885	100.0
Per Cent	9.1	4.1	3.5	2.4	0.8	0.2	19.9	31.9	16.5	12.2	13.9	2.7	2.9	80.1		

*VF denotes fighter; VSB, scout bomber; VTB, torpedo bomber; VPB, patrol bomber; VB, bomber; and NC, "not classified."

TABLE 2.2

FREQUENCY OF NOMINATION AMONG VARIOUS SPECIALTIES -- LOW GROUP
PRELIMINARY FIELD INVESTIGATION
(N = 1793)

12-26-44, CLV

No. of Times Nomin.	No. of Individuals with Summary Responses							No. of Indiv. with Single Entry Responses								GRAND TOTAL	
	VF	VSB	VTB	VPB	VB	NC*	Total	VF	VSB	VTB	VPB	VOVS	VB	MC	Total	No.	Per Cent
20																	
19																	
18		1					1									1	0.1
17	1						1									1	0.1
16																	
15																	
14																	
13																	
12																	
11																	
10		2					2									2	0.2
9		1	1		1		3									3	0.3
8		3	3	1			7			1					1	8	0.9
7		1	1		1		3		1						1	4	0.5
6	2	1	1				4									4	0.5
5	4	2	3				9	2							2	11	1.3
4	7	2	2	1		1	13	1			1				2	15	1.7
3	13	13	6		2		34	8	5	8	4				25	59	6.9
2	21	13	12	9	2		57	29	19	13	7		1	3	72	129	15.0
1								261	149	87	101	1	11	14	624	624	72.5
Total	46	39	29	11	6	1	134	301	174	109	113	1	12	17	727	861	100.0
Per Cent	5.6	4.5	3.4	1.3	0.7	0.1	15.6	35.0	20.2	12.7	13.1	0.1	1.4	2.0	84.4		

*VF denotes fighter; VSB, scout bomber; VTB, torpedo bomber; VPB, patrol bomber; VB, bomber; and NC, "not classified"; VOVS, fleet observation.

named the same individual, and second, by the striking agreement among respondents with respect to certain individuals named as many as 20 times. Perhaps a more accurate indication of reliability is obtained by using as a base all individuals multiply nominated. If this is done, the proportion of mixed cases becomes 8.8%. A later chapter will include further discussion of the problem of reliability.

Frequency of Use of Categories

One of the objectives of the combat criterion program was the determination of the traits most commonly found in pilots designated as "wanted" or "not wanted" in the combat areas. It was thought that such a determination would suggest what kinds of things to emphasize in setting up selection procedures. It was the considered opinion of the APB that the frequency with which the various categories were used in coding respondent statements would yield an adequate indication of the importance of the "traits" in the combat area. This assumption was later challenged as a result of a direct study of the judged importance of the categories, but frequency tables are presented here as valuable at least in a descriptive sense, in that they indicate the frequency with which various types of statements were made about combat pilots, and indicate the aspects of pilot performance most frequently talked about by the respondents. It must be remembered that these frequency tables refer to codings of statements freely and spontaneously given by the respondents, not to traits indicated on any sort of checklist or form. This is significant because certain frequency tables to be presented later in this report are based on a trait checklist.

There are two methods of stating the relative frequency of the categories. One involves the use of the coded response as a unit; the other uses the individual nominee as the unit, regardless of the number of times he was nominated, and regardless of the frequency with which a category was used for a single nominee. Indication of the relative frequencies of categories in terms of both methods of presentation is given in Table 2.3 for the response considered as a unit, and in Table 2.4 for the individual considered as a unit. The rank-order correlation coefficients (Rho) between the frequencies of the categories as placed by the two methods are above .99 in these data.

Categories used most frequently in describing "Highs" and "Lows." One of the striking things to be observed in the tables is the fact that the most frequently used categories for the Highs are not in every case the same as those for the Lows. In fact, the rho between the frequencies for Highs and Lows is only .69, when the individual is considered the unit, and also a .69 when the response is considered as the unit. Categories which are used very frequently for both the Highs and the Lows are the following, "P" indicating a positive statement, "N" a negative statement:

> P. This man sizes up situations well in the air; uses effective tactics, varying them appropriately when necessary to depart from a pre-arranged plan.

TABLE 2.3

FREQUENCY OF USE OF CATEGORIES, IN PRELIMINARY FIELD INVESTIGATION, IN TERMS OF CODED RESPONSE AS A UNIT

	HIGHS		LOWS	
Category	No. of Responses	Rank	No. of Responses	Rank
1	106	15	256	3
2	534	1	202	6
3	127	12	98	12
4	354	3	235	5
5	71	20	267	2
6	526	2	255	4
7	323	5	182	7
8	124	13	32	23.5
9	5	31	41	20
10	7	29	22	26
11	102	17	76	14.5
12	165	11	112	10
13	242	8	32	23.5
14	195	10	55	17
15	59	21	15	29
16	81	18	53	18
17	2	32	19	27
18	120	14	2	32.5
19	49	22	2	32.5
20	75	19	23	25
21	47	23	110	11
22	18	25.5	56	16
23	103	16	76	14.5
24	45	24	52	19
25	18	25.5	36	21
26	14	27	33	22
27	0	33	3	31
28	7	29	18	28
29	7	29	7	30
100	337	4	418	1
101	255	7	164	9
102	241	9	166	8
103	261	6	97	13

TABLE 2.4

FREQUENCY OF USE OF CATEGORIES IN PRELIMINARY FIELD INVESTIGATION, IN TERMS OF INDIVIDUAL NOMINEES AS A UNIT**

	HIGHS			LOWS		
Category	No. of Individuals	Rank	Per Cent of Individuals	No. of Individuals	Rank	Per Cent of Individuals
1	102	17	12	248	2	29
2	470	2	55	186	6	22
3	146	12	17	95	12	11
4	345	4	41	201	5	23
5	84	19	10	246	3	29
6	498	1	59	237	4	28
7	315	5	37	164	7	19
8	137	13	16	28	24	3
9	7	29	*	35	21	4
10	6	31	*	23	26	3
11	105	16	12	77	14.5	9
12	194	11	23	104	10.5	12
13	271	6	32	32	22	4
14	197	10	23	52	19	6
15	67	21	8	15	28	2
16	90	18	11	54	17	6
17	3	32	*	13	29	2
18	127	14	15	3	31	*
19	49	23	6	2	32.5	*
20	69	20	8	24	25	3
21	50	22	6	104	10.5	12
22	18	26	2	55	16	6
23	113	15	13	77	14.5	9
24	48	24	6	53	18	6
25	20	25	2	36	20	4
26	15	27	2	31	23	4
27	0	33	0	2	32.5	*
28	7	29	*	18	27	2
29	7	29	*	5	30	*
100	371	3	44	366	1	43
101	269	7	32	150	9	17
102	241	8	28	158	8	18
103	237	9	28	87	13	10
Total	851			860		

*Less than .01 per cent.

**Based upon 1792 nominations.

N. This man is deficient in one or more of the following: sizing up situations in the air; using sound tactics, or varying his procedure when required.

2. P. This man's basic flying skill comes up to the level expected of combat pilots.

N. This man fails to come up to the minimum level of flying skill required of combat pilots.

100. P. This man dependably maintains his position in formation.

N. This man is erratic, undependable. He fails to maintain his position in formation through failure of air discipline, laziness, or roughness on the controls.

4. P. This man meets combat requirements in aggressiveness, self-confidence, courage, and willingness to press home the attack.

N. This man fails to meet combat requirements in at least one of the following: aggressiveness, self-confidence, courage, or willingness to press home the attack. He may be called overcautious.

7. P. This man remains cool and unexcited in emergencies.

N. Although this man may do well in favorable circumstances, he tends to fail when put under pressure. In adverse circumstances he may blow up.

Categories in which the positive sense is used much more frequently than the negative sense are the following:

14. P. This man has a good knowledge of navigation, aerology, theory of flight, aircraft construction, engines, etc.

N. This man is deficient in one or more of the following: navigation, aerology, theory of flight, aircraft construction, engines, etc. He may also lack adequate knowledge of instruments, special equipment, or placement of controls.

12. P. This man keeps in mind the safety of all personnel for whom he is responsible. In combat operations, he helps those in trouble.

N. This man is overly interested in his own safety in combat, even at the expense of his squadron mates.

8. P. This man makes plans ahead of time, reviewing situations which might later arise.

N. This man does not adequately think ahead. He fails to review situations which might arise.

Conversely, categories in which the negative sense is used much more frequently than the positive sense are the following:

1. P. This man is primarily a teamworker rather than an individualist.

   N. This man persists in individualistic, non-cooperative behavior. He does not fit into the team to produce best results.

5. P. This man takes criticisms and suggestions well.

   N. This man tends to reject criticisms and suggestions. He is cocky, conceited, and has a 'know it all' attitude.

21. P. This man enjoys flying military aircraft.

    N. This man either lacks desire to fly military aircraft or exhibits a dislike for aerobatics or close formation.

Thus, the "traits" of pilots nominated for the Low group which draw special criticism are poor teamwork, poor reaction to criticism, and lack of desire to fly military aircraft.

Category use in relation to specialty. The question has been raised as to whether certain traits are mentioned more frequently in some specialties than in others. The frequencies with which the categories were mentioned in the negative sense for Low nominees are presented in Table 2.5, classified by the specialties of the nominees. In this table, the unit is the coded response, not the individual. Rho's between various specialty groups are as follows:

	Rho
VF vs. VTB[2]	.93
VF vs. VSB	.95
VTB vs. VSB	.94
Total Carrier vs. VPB	.83

The three carrier specialties are not sufficiently different with respect to the frequency of categories to justify any conclusions as to the traits emphasized in each specialty. The contrast between carrier and multi-engine (VPB) types is somewhat more marked, but actually most of the differences between ranks of categories come in the less frequently mentioned categories. The only striking difference comes in category 100, "undependable." This category holds first place in frequency among low nominees for the carrier pilots, but only 10th place for the multi-engine pilots. This difference might have been expected because of the reference

[2]VF denotes fighter; VTB, torpedo bomber; VSB, scout or dive bomber; and VPB, patrol bomber or "Big Boat."

TABLE 2.5

FREQUENCY OF CATEGORY USE IN DESCRIBING LOW NOMINEES BY SPECIALTIES
(Coded response employed as unit)

Category	VF No.	VF Rank	VTB No.	VTB Rank	VSB No.	VSB Rank	TOTAL CARRIER No.	TOTAL CARRIER Rank	VPB No.	VPB Rank
1	118	2	50	3	64	2	232	2	24	11
2	77	6.5	48	4	44	6	169	6	33	6
3	30	13	23	10.5	27	10	80	12	18	12.5
4	110	3	37	6	57	5	204	5	31	7
5	109	4	54	2	58	4	221	3	46	2
6	107	5	41	5	60	3	208	4	47	1
7	77	6.5	31	8.5	40	8	148	7	34	5
8	10	23.5	7	22	5	24.5	22	24	10	17
9	15	21	11	18	11	19	37	19.5	4	24.5
10	7	27.5	6	23.5	5	24.5	18	26	4	24.5
11	21	16.5	23	10.5	21	15	65	14	11	15.5
12	48	11	12	17	22	13.5	82	11	30	8
13	12	22	5	25	13	17	30	21	2	27.5
14	17	20	13	14.5	7	22	37	19.5	18	12.5
15	10	23.5	3	26	2	29	15	27	0	31.5
16	23	15	15	12	12	18	50	16.5	3	26
17	9	25.5	6	23.5	4	27	19	25	0	31.5
18	1	32	0	32	0	32	1	33	1	29
19	0	33	2	28	0	32	2	32	0	31.5
20	6	29	2	28	4	27	12	28.5	11	15.5
21	59	9	13	14.5	25	12	97	10	13	14
22	18	19	10	20	22	13.5	50	16.5	6	21
23	36	12	13	14.5	18	16	67	13	9	18
24	29	14	10	20	8	20.5	47	18	5	23
25	20	18	2	28	6	23	28	22	8	19
26	9	25.5	10	20	8	20.5	27	23	6	21
27	3	21	0	32	0	32	3	31	0	31.5
28	7	27.5	1	30	4	27	12	28.5	6	21
29	4	30	0	32	1	30	5	30	2	27.5
100	179	1	106	1	105	1	392	1	26	10
101	58	10	33	7	37	9	128	9	36	4
102	66	8	31	8.5	41	7	138	8	28	9
103	21	16.5	13	14.5	26	11	60	15	37	3

in category 100 to undependability in formation flying: it is well known that formation flying is not as widely practiced by Navy multi-engine pilots as by carrier pilots. On the whole, the difference between carrier and multi-engine pilots revealed in Table 2.5 reflect differences in their jobs and not in the traits making for acceptance or lack of acceptance. It must be remembered, too, that the frequency with which the categories appear are not necessarily related to their relative importance.

Grouping of the Categories.

On the one hand, the AFB strove to secure the utmost purity or homogeneity of category groups by deliberately aiming for specificity in the category statements. The final outcome of this effort, as mentioned above, was a list of 33 categories or "traits" to be used in coding free responses. This level of specificity was believed desirable for the purpose of finding whether the predictors tended to pick men who were acceptable or unacceptable for certain narrowly-defined reasons. On the other hand, it was realized that for various practical purposes a set of several **broad** categories would be useful. For one thing, a small number of categories would facilitate certain types of research in the AFB, for example, item analysis of the Biographical Inventory. It was also true that the sponsor of this project -- the Navy aeronautical organization -- could make better use of the data in terms of a small number of groupings than in terms of 33 finely-divided categories.

At least four methods of arriving at broad categories in a valid fashion were conceived:

1. Having AFB personnel sort the categories into clusters or groups on the basis of presumptive psychological similarity.

2. Having combat pilots sort them in terms of apparent similarity, judged on the basis of intimate acquaintance with performance in aerial combat.

3. Factor analysis of correlations between category placements.

4. Successively adding categories to selected nuclei to determine grouping in terms of changes in correlation coefficients, or critical ratios.

Method A, Groupings by AFB Personnel. Method A was tried out very soon after the returns started to come in. Indeed, the first attack on coding the responses was made with the aim of constructing a small number of broad categories rather than a larger number of specific ones. One of the earliest runs yielded the following broad categories:

1. This category includes cases showing marked escape or breakdown symptoms under pressure of actual combat conditions. In some instances flight surgeons have already

grounded the pilots; in other instances fear behavior is clearly incident to the rater. Withdrawal behavior is generally characteristic of the group, rather than aggressive or compensatory behavior. Hypochondriasis, hysteria, and anxiety states are included.

2. This category includes lack of basic flying ability, inadequate "air wisdom," poor flying judgment in mistakes of both omission and commission. It represents ineffective use and integration of the knowledge and skills presumably built up in total pilot training.

3. This category includes cases whose social skills or "social intelligence" are inappropriate to the group living and social demands of the homogeneous squadron situation. This unpopularity and isolation from the group is the primary emphasis in the rater's judgment.

4. This category includes pilots who persist in an individualistic, non-teamwork, erratic, or unpredictable type of combat flying, with possible danger to themselves or their squadron mates. They have apparently not learned team flying or to take orders as member of a team. Although such behavior may be regarded as compensatory "showing-off," the raters consider it irresponsibility, unpredictability, or inadequate drive for real combat flying.

These groupings were built up from the categories constructed by five judges who attempted to classify 163 Low cases. Preliminary statistical analysis showed some consistent ranking of frequency of reasons for poor combat ratings and some consistency of use of these reasons by pairs of judges.

Agreement was not secured on the final list of categories (which was to be used in coding the material for all later work) until 30 October 1944. This is the list shown as Appendix 2-B. Subsequently, attempts were made to group these categories into superordinates; seven categories were omitted from consideration, however, because of the low frequency with which they had occurred in the coding. The final groupings resulting from discussion among the officers in the Branch were the following:

1. (Teamwork)
   Categories 1, 3, 5, 12, 13, 100

2. (Emotional Stability)
   Categories 4, 7, 101

3. (Practical Intelligence)
   Categories 6, 8, 11, 16, 22, 23

4. (Officer-Like Qualities)
   Categories 9, 17, 24, 28, 102, 103

5. (Basic and Accessory Skills)
   Categories 2, 10, 14, 15, 21

<u>Method B. Grouping by Pilots</u>. A serious weakness of Method A was the fact that none of the H(S) officers who made the groupings had ever flown in combat and none had anything more than a second-hand acquaintance with the requirements of combat aviation. Accordingly it seemed advisable to try out Method B, using pilots who, through first hand contact, would have intimate acquaintance with the determinants of performance under fire in a combatant air group. The opportunity for such a survey was presented when Comdr. Jenkins was invited to accompany Air Group 16, then in the re-forming stage, on its shakedown cruise. The veterans in this air group were known to the investigator as a result of an earlier tour of duty with the original squadron.

There were 40 second-tour men available from the original air group, 39 of whom submitted to an interview involving a variety of topics of current interest to BuMed. By way of introduction a review was given of the previous year's work, during which each respondent read and discussed the basic category-statements employed in this study.

The original 33 unit-categories had been reduced to 26 by eliminating 7 which had proved to have low frequency of use in the first 1500 nominations.[3] The statements, furthermore, had been re-phrased in pilot language. This had been done by assembling all of the unit-entries coded by the APB judges under a given category and then framing a 'model' statement of each in the language of the original respondents. These 'model' statements were then typed on cards in the form shown in Appendix 2-C. Only the negative statements were used in this study.

As the cards were handed to the respondent, the following instructions were given:

> "In going over the cards previously you probably noticed that certain of the cards seemed to go together into natural groups or families. That is, although they were not identical, you may have found several cards that were concerned with the same general sort of behavior. For example, some people feel that #11 and #23 fall naturally into the same general family? (laying the two cards out before the respondent.)

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[3]Categories 18, 19, 20, 25, 26, 27, and 29 were eliminated.

"Now will you take the cards and sort them into as many piles as you wish, putting into a pile only those cards that seem to you belong to the same general family of behavior. You may end up with two piles or ten or fifteen, depending on how many different families there seem to you to be. Do you understand? Have you any questions?"

Thirty-nine veteran pilots completed the sorting called for, with results as shown in Appendix 2-C. An explanation of the diagrams given there is in order: A triple line between two categories indicates that at least 2/3 of the respondents placed the two cards in the same pile. A double line indicates agreement by at least 1/2 of the respondents; and a single line agreement by at least 1/3. A cluster was regarded as established only if (a) the unit categories involved were placed in the same pile by at least 2/3 of the respondents, or (b) the unit categories exhibited multiple interconnections. Connections which failed to meet these standards are indicated by uncircled numbers in the diagrams of Apprndix 2-C. It should be noted that it would be possible to arrange the pilots' data on clustering in a variety of ways. The arrangement shown in Appendix 2-C, is illustrative rather than mandatory. The standards cited above were abrogated on two occasions in order to avoid undue complexity in the diagrams. Nevertheless, alternative ways of arranging the categories, starting from the raw data, would not permit much deviation from the fundamental clusters emerging from the data. Arbitrary decisions would be necessary only in the matter of allocating certain categories to the fundamental clusters.

It was striking that the tabulation of the pile-entries made by the pilots showed a definite clustering of the basic categories. In other words, there was considerable agreement as to which cards went together, rather than a random scattering of the pile entries. The six clusters obtained exhibited a multiplicity of internal connections, and the rarity of external connections from the clusters was noteworthy. The clustering produced by the pilots was closely related to, but not identical with, the general trend of sortings made by the H(S) officers. The final H(S) groupings (made before the pilot survey) and the pilot groupings are contrasted as follows:

AIB Clusters	Pilot Clusters
1. Teamwork 1, 3, 5, 12, 13, 100	1. Lacking in Teamwork 1, 3
2. Emotional Stability 4, 7, 101	2. Lacking in Motivation for Combat Aviation 4, 21
3. Practical Intelligence 6, 8, 11, 16, 22, 23	3. The Emotionally Inadequate 7, 100, 101, 102
4. Officer-Like Qualities 9, 17, 24, 28, 102, 103	4. Intellectually or Perceptually Inadequate 6, 8, 11, 16, 22, 23

5. Basic and Accessory Skills 2, 10, 14, 15, 23	5. Lacking Minimal Skills 2, 14, 15
	6. Immature 3, 5, 9, 10, 12, 17, 24 (Not clustered: 28, 103)

This comparison is presented so that the reader may establish his own comparison of sortings made by the pilots and those made by the H(S) organization.

Method C, Correlational Analysis. Methods A and B involved subjective judgments of similarity between traits. It was believed that empirical studies of the actual concomitance of the traits as coded would yield more objective results. Accordingly, an attempt was made to construct clusters of categories on the basis of their intercorrelations (Method C.) These correlations were to be based upon tables of the following form, obtained separately for the Highs and the Lows:

		Category x: Absent	Category x: Present
Category y	Present	f_{pa}	f_{pp}
	Absent	f_{aa}	f_{ap}

In such a table the f's would represent the frequencies (taken over individual nominees) with which the categories were used (or failed to be used) in coding statements about the nominees. Several problems arose, however, with respect to the rationale of the correlations.

1. If two categories were in fact highly related, the respondents might tend to use either one or the other of the two modes of statement, but not both. If cases nominated only once were used, this might result in a perfect negative correlation between two categories.

2. For cases nominated more than once, errors of measurement might tend to increase the diversity of statements made about the nominees, with the effect of spuriously increasing the concomitance of categories.

3. The above factors would operate differently in three groups of cases, viz.:

a. Cases nominated once.

b. Cases nominated more than once, and for whom separate statements from the various respondents were available.

c. Cases nominated more than once, and for whom a single paragraph summarizing the respondent's statements was written by the field investigator.

Tetrachoric correlations were found between category 1 and all others, separately for the Highs and Lows, and for the three groups of cases mentioned above. Of some 50 coefficients which were obtained in this sample run, the highest was .58, while the lowest was -.20. However, the results were not consistent between the three groups of cases mentioned above, or between the Highs and the Lows. It was accordingly decided to postpone further use of correlational techniques until better and more voluminous data -- preferably based on some sort of checklist -- became available.

<u>Method D, "best predictable" groupings.</u> Still another relatively objective method (Method D) of grouping categories was possible. This would be to group together any categories which provided a good criterion for a given predictive measure (e.g., a psychological test.) Thus, if one had categories numbered 1 to 10, and categories 3, 5, and 6 were especially well predicted by the Mechanical Comprehension Test, one would be tempted to group those categories on the presumption that they all reflected a fundamental trait measured by the predictive test. This procedure was carried out experimentally in the case of the Mechanical Comprehension Test. It had been found (as will be seen later) that the categories best predicted by the MCT (with P values from the X^2 test less than .01) were categories 2, 6, 7, 100, and 101. In a re-run of 709 cases (285 Highs and 424 Lows) having scores on the MCT available, it was found that a X^2 value of 32.09 could be obtained for the 257 Highs and 333 Lows who had been coded in <u>any one</u> (or more) of the categories 2, 6, 7, 100, and 101, i.e., that High and Low pilots, in terms of these categories, were differentiated also in terms of MCT scores. With three degrees of freedom this chi-square was well below the 1% level of significance, but the value was not quite as high as that for the over-all prediction of Highness and Lowness afforded by the MCT. However, when the value was converted into a contingency coefficient, it became slightly higher (.226) than the corresponding coefficient (.212) for the total group of cases without regard to category. The difference can hardly be thought significant. With respect to the data available it did not seem promising to pursue this matter further. It seemed to be true that combinations of categories made in this manner simply piled up the number of cases in such a way that practically <u>all</u> the cases were included in a given combination of categories. Since the X^2 values for the total distributions of test scores in terms of Highs and Lows without regard to categories were highly significant, any combination of categories which included nearly all of the cases would inevitably yield a significant X^2 value.

Relative Functional Importance of the Categories

One of the preliminary studies made by the APB concerned the relative importance of the categories as "traits" in combat flying. In certain applied fields of socio-psychological research, notably market research, conclusions and recommendations have often been predicated on the assumption of a high correlation between the frequency of spontaneous responses to free inquiry and their functional importance. That is to say, there has long been a tacit assumption that the relative importance of a free response answer was accurately indicated by the relative frequency with which it was given.

Consider, for example, the conventional interpretation of market survey results. A thousand respondents have been asked to name what they want in the next car they buy. If 76% name "smoothness of operation" and only 42% mention "economy of upkeep," practice has been to assume from these results that smoothness is more important to this group than economy.

The Aviation Psychology Branch had available tabulations of the frequency with which the various unit-categories had been used by the first 1000 respondents. If there had been administrative pressure for a quick report of what these tabulations indicated, the Branch would have felt justified in arranging the unit-categories in an 'order of importance,' based solely upon the frequency with which they had been named.

Procedure for determining "importance" of categories. The correctness of the basic assumption was challenged by several members of the Branch. It seemed worthwhile, therefore, to make a first-hand survey with veteran pilots revisited by Cdr. Jenkins on their shake-down cruise. Each of the pilots was handed the pack of cards previously described, containing descriptions of 20 "Low" categories phrased in pilot language. He was then asked to sort them into four piles, according to the following printed instructions:

Pile #1 Very serious defects and drawbacks. Men described by these cards should be put on the beach for the good of the squadron.

Pile #2 Serious defects. These traits in a man make him a real liability to his combat team.

Pile #3 Minor drawbacks. A man's usefulness to a combat team is somewhat reduced by these traits.

Pile #4 Unimportant items. While some people might dislike these traits, it is my opinion that they make little difference in a man's value to a combat team.

After the respondent pilot had made his four basic piles, he was then asked to take Pile #1 and arrange the cards within this pile in the order of their relative importance to an operating air group -- according to his view of the situation. Similar treatment was then asked for the remaining three piles.

<u>Comparison between "Frequency" and "Importance."</u> Table 2.6 shows the comparative rank-orders for importance and for frequency of the "Low" unit-categories. The rank-order for <u>importance</u> is based upon the returns from these 39 veteran pilots. It was obtained by assigning 4 points for entries in Pile #1, 3 points for Pile #2, 2 points for Pile #3, and 1 point for Pile #4. (The rank-order correlation between weighting-for-pile only and weighting-for-average-rank-in-whole series was .99.) Due to changes in method, it was not possible to obtain rankings for <u>frequency</u> from the responses of the 39 pilots; accordingly this tabulation is adapted from data in Table 2.5, based on the "Total Carrier Pilot" group.

The rank-order correlation between order-of-frequency and order-of-importance for these data is .56. Even though this coefficient reflects significant covariability in the two rank-orders, one should not ignore the dramatic changes in placement of certain categories. Most striking is the behavior of category 13 ("He would save his own neck ....") which is 21st in <u>frequency</u> but of first rank in <u>importance</u>. The practical implication of the findings in terms of the determination of Navy policy is obvious: Certain aspects of combat performance are not frequently mentioned by the pilots but are of such critical importance to them that strenuous efforts should be made to prevent men with deficiencies in those aspects from ever reaching combat areas.

One might speculate on the reasons for the lack of agreement between ranking of categories by <u>frequency</u> and by <u>importance</u>, particularly since these results are apparently at variance with the usual findings in market research. A number of hypotheses can be offered. In the first place, the form of the question asked the pilots may have led to their mention of traits which were not actually of critical importance to them in combat operations. The pilots were asked to describe their <u>nominees</u>, not to describe the ideal pilot or the worst conceivable pilot, a question which might have been asked if the usual pattern of market research had been followed. The descriptions thus elicited may have included a number of relatively perfunctory statements along with the statements of essential importance. In the second place, the pilot nominees who were described by the respondents had been subjected to factors of natural selection and survival during their careers in Naval aviation -- careers which had lasted a minimum of two years and probably on the average three or four years. It could not be expected that the resultant group of nominees would include more than a very few individuals with the more extreme deficiencies. It is not surprising, therefore, that some of the critically important traits were very infrequently mentioned in the descriptions of "not wanted" pilots. Nevertheless, it is true that certain highly undesirable traits occur quite widely among the pilot population. With respect to these traits, it appears that processes of natural selection have broken down.

It was noteworthy that, out of 1014 entries in all piles, only 27 entries were made in Pile #4, the 'unimportant' pile. The pilots were not inclined to dismiss any one of the categories as trivial, even though they recognized variation in the importance of the categories.

TABLE 2.6

THE RELATIONSHIP BETWEEN RANK-ORDER OF IMPORTANCE AND RANK ORDER OF FREQUENCY-OF-USE

Category*	Importance Rank**	Frequency Rank***
13	1	21
1	2	2
7	3	7
100	4	1
22	5	16
4	6.5	5
2	6.5	6
21	8	10.5
101	9	9
103	10	13
16	11	17
6	12	4
8	13	22
23	14	14.5
3	15.5	12
11	15.5	14.5
12	17.5	10.5
14	17.5	19
5	19	3
102	20	8
17	21	26
24	22	18
10	23	23
15	24.5	25
28	24.5	24
9	26	20

*Only "Low" categories were considered in this comparison. The categories to which the "frequency rank" applies are given in Appendix 2-B. The categories to which the "importance rank" applies are given in Appendix 2-C, where the category designations are rephrased in "pilots' language." The fact that the definition of categories differ slightly, in terms of phraseology, for the Importance and Frequency comparisons, respectively may, to some degree, contribute to the lack of relationship between the two rank-orders.

**Importance rank is based upon scores obtained by assigning 4 points for sorting in Pile #1, 3 points for Pile #2, etc., based upon responses of 30 combat pilots.

***Frequency-rank is based upon frequency of use by the first 300 respondent pilots, as determined by coding free-essay materials into a series of "categories."

Test Score Distributions of High and Low Combat Cases

One major aim of the combat criterion program has been to determine whether the Cadet Selection Tests, originally validated against the cadets' success in training, would predict the combat performance of those who graduate. It was desired to know whether the tests would to any extent discriminate between those who did well in combat and those who performed poorly in combat. The criterion of performance in combat was to be afforded by the nominating technique.

Sample available. A preliminary analysis was made possible by the availability of the 1793 nominees obtained between 15 February and 15 December 1944. Checking in APB files revealed that there were a total of 913 cases (409 Highs and 504 Lows) for whom scores were available on one or more tests. The cases not used in the analysis included 47 cases nominated for both the high and low groups, 55 cases in which no reasons for the nominations had been given, and 778 cases for whom no test information was available. Of the 913 cases, approximately three-fourths were carrier pilots, one-eighth were patrol boat pilots, and the remainder were spread out through the various other specialties. About a third of the Highs and a fourth of the Lows had been chosen by more than one respondent.

Test data. At the time these men were examined (for the most part, during 1941 and 1942) the following tests were in use:

1. Personnel Test (PT)
2. Mechanical Comprehension Test, Mark 2 (MCT)
3. Biographical Inventory (BI)

In addition to scores on the individual tests, it was possible to assign Flight Aptitude Ratings to all men who had taken both the MCT and the BI.[4]

Each of these tests, or its counterpart, was used in selection, and each predicted success in training. The Personnel Test is a test of "general intelligence," and was supplanted by the Aviation Classification

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[4] Each of these tests is described in another historical report. See: Fiske, D. W. Validation of naval aviation cadet selection tests against training criteria. Jl. Appl. Psychol., 31, 6, December 1947, pp. 601-614. The report also presents data concerning the extent to which the tests predict success in training. The Flight Aptitude Rating is an index derived from the following table.

MCT

	A	B	C	D	E
BI	A	A	A	C	D
	A	A	C	D	D
	B	B	C	D	E
	B	C	D	E	E
	C	D	E	E	E

Test in November 1942. The names of the other two tests are self-explanatory. Mark 2 of the MCT has since been superseded by Forms 3, 4, and 5 of the same test, but these later forms are designed to measure essentially the same abilities.

The BI given the men appearing in the criterion groups contained all but 39 items included in the form current, as of March 1946, but the answer sheets for the combat groups were scored with the key used routinely in the APB from September 1942 until May 1944.

From one to three years had elapsed between the time of testing and the time the pilots were nominated, and it can safely be said that in no case did the respondent know the test scores which his nominee had made. With the exception of a small number of cases examined in 1943, the men were tested in 1941 and 1942, with peak frequencies in the second quarter of 1941 and the third quarter of 1942.

Statistical Treatment of the Data. The basic tables present, separately, the raw score or letter grade distributions for the Highs and for the Lows. Since no information is at hand regarding the size of the non-nominated population or the test scores made by pilots who could have been but were not nominated, it does not seem theoretically justified to apply any measure of correlation between the criterion and the predictive variables. A biserial correlation coefficient could not be used since it assumes that the criterion and the predictive variables are represented by a continuous distribution -- an assumption which would not hold for these data since a presumptive middle group -- the non-nominated pilots -- are not present in the combat criterion. Use of a triserial correlation coefficient would require an estimate of the relative proportions represented by the High and Low groups with respect to the total population of potential nominees. A contingency coefficient would be subject to the same dangers of misinterpretation as the biserial correlation coefficient.

The only valid technique by which these data can be analyzed appears to be a test of the statistical independence of the distributions of scores for the High and Low groups. If the two distributions, for any given predictor, are shown to be statistically independent within the usual probability limits, the conclusion could be drawn that there is a factor or a complex of factors which serves to differentiate the Highs and the Lows. It would be recognized that a diversity of factors could conceivably produce such a differentiation, and studies could be instituted to narrow the range of possible differentiating factors until one could put his finger on the most potent of these. It would not be correct to draw the immediate conclusion that the trait measured by the predictive test is producing the differentiation. An alternative hypothesis which would demand careful consideration is that extraneous factors not associated, per se, with the test variables themselves would produce a differentiation. Selection and training standards underwent considerable changes during the course of the war. One of the most important changes, in April 1942, was the lowering of the standards to admit candidates with less than two years of college. If the Highs typically came from the better educated applicants while the Lows were drawn

largely from applicants admitted after the lowering of standards, a differentiation between the test score distributions of Highs and Lows would merely reflect the extent to which the tests are affected by amount of education.

The test of statistical independence applied to this data has been in all cases the X^2 (chi-square) test. The X^2 test shows the independence of the total test-score distributions rather than the means of the distributions. Two distributions with identical means could be statistically independent as a result of variation in the form of distribution. Critical ratios between means have therefore been employed only as a secondary check. For purposes of computing X^2, the distributions were arbitrarily divided into four intervals. The divisions were not in any way mandatory but were established by inspecting the distributions with the aim of establishing the divisions which would give the best possible differentiation.*

In the following tables the data are accordingly presented both in full and in terms of the arbitrary divisions made by the computers. The reader may wish to experiment with different cutting points.

Prediction by the Personnel Test. Among the 1793 cases, Personnel Test scores were available on 379 Highs and 457 Lows. In Table 2.7 is indicated the score distributions of these groups and the division points on which the X^2 test was based. The X^2 value derived was 12.86. With 3 degrees of freedom this value has a probability value of less than .01, indicating that two such divergent distributions could emerge by random sampling of the population less than once in 100 times. The mean scores of the Highs and Lows are, respectively, 30.41 and 29.46; the critical ratio between these means is 2.68, which has a probability value of .01. On the average, then, the men appearing in the High group make somewhat better scores than those in the Low group.

Had the cutting score of 23, adopted at one time on the PT, been followed vigorously, 15% of the Lows would have been eliminated when they applied for training; at the same time, only 7% of the Highs would have been rejected. This statement (along with similar statements relative to the other tests) is made on the assumption that extraneous factors of selection did not produce the differentiation between the High and Low groups. The differentiation does not, however, occur in all portions of the test score distributions. For example, if only men making scores of 38 or higher on the test had been selected, a slightly larger percentage of Lows (8.8%) than Highs (8.2%) would have been chosen.

Prediction by the Mechanical Comprehension Test. Scores of the two groups on the Mechanical Comprehension Test are given in Table 2.8. Scores

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*Editor's note. It is recognized that breaking the test score distributions (for the PT and other tests as described on this and the following page) at the point of maximum differentiation yields a somewhat inflated measure of differentiation, in terms of chi-square, since it could not be expected that on further independent samples differentiation of this order would be obtained at these specific cutting scores. It should be emphasized that chi-square was employed primarily to yield a convenient index of the relative differentiation provided by the three tests on this particular sample.

TABLE 2.7

DISTRIBUTION OF SCORES AND CUMULATIVE PER CENTS
PERSONNEL TEST: COMBAT HIGHS AND LOWS
(Preliminary Field Investigation)

816 Cases from Group of 1795 — 1-1-42

	HIGHS		LOWS	
Scores	No. of Cases	Cumulative Per Cent	No. of Cases	Cumulative Per Cent
46			1	100.0
45	2	100.0		
44	1	99.5	1	99.8
43	3	99.2	5	99.6
42	4	98.4	3	98.5
41	6	97.4	6	97.8
40	3	95.8	6	96.5
39	7	95.0	9	95.2
38	5	93.1	9	93.2
37	15	91.8	11	91.2
36	19	87.9	14	88.8
35	17	82.8	24	85.8
34	20	78.4	17	80.5
33	25	73.1	19	76.8
32	21	66.5	25	72.6
31	26	60.9	30	67.2
30	30	54.1	37	60.6
29	36	46.2	44	52.5
28	28	36.7	28	42.9
27	28	29.3	27	36.8
26	23	21.9	25	30.9
25	20	15.8	25	25.4
24	12	10.6	24	19.9
23	7	7.4	26	14.7
22	4	5.5	15	9.0
21	3	4.5	8	5.7
20	6	3.7	2	3.9
19	3	2.1	6	3.5
18	3	1.3	5	2.2
17	2	0.5	1	1.1
16			2	0.9
15			1	0.4
14			1	0.2
Total	379		457	

*Cutting points used in collapsing these distributions for computations of chi-squared are indicated by lines.

TABLE 9.8

DISTRIBUTION OF SCORES AND CUMULATIVE PER CENTS
MECHANICAL COMPREHENSION TEST: COMBAT HIGHS AND LOWS
(Preliminary Field Investigation)

710 Cases from Group of [illegible]

	HIGHS		LOWS	
Scores	No. of Cases	Cumulative Per Cent	No. of Cases	Cumulative Per Cent
75-76				
73-74	2	100.0	1	
71-72	1	99.3		
69-70	6	98.9	1	99.8
67-68	9	96.8	3	99.5
65-66	8	93.7	15	98.8
63-64	13	90.9	14	95.3
61-62	24	86.3	16	92.0
59-60	21	77.9	26	88.2
57-58	37	70.5	47	82.1
55-56	41	57.5	47	71.1
53-54	27	43.2	53	60.0
51-52	29	33.7	45	47.5
49-50	23	23.5	35	36.9
47-48	16	15.4	37	28.7
45-46	12	9.8	35	20.0
43-44	6	5.6	26	11.8
41-42	4	3.5	11	5.6
39-40	5	2.1	7	3.1
37-38	1	0.4	4	1.4
35-36			1	0.5
33-34				
31-32			1	0.2
Total	285		425	

*Cutting points used in collapsing these distributions for computations of chi-squared are indicated by lines.

were available for 285 Highs and 425 Lows from the sample of 1793 cases under study. The X^2 value for the table, based upon the indicated dividing points, is 26.93, with a probability value of much less than .01 for 3 degrees of freedom. The means for the Highs and Lows, respectively, are 55.36 and 52.68. Had the cutting score of 44 (the cutting score in use since 15 May 1944) been followed in selecting these men for aviation training, 12% of the Lows at the expense of only 6% of the Highs would have been eliminated before the men ever reached training. Whereas the PT does not differentiate the groups at the upper score levels, the MCT does to some extent. If only those making a score of 62 or better on the MCT had been admitted to training, 22% of the Highs as opposed to 12% of the Lows would have been selected.

Prediction by the Biographical Inventory. The basic score distributions of Highs and Lows aregiven in Table 2.9. Although on the average the Highs had better scores on the BI than the Lows, and the difference between the means (22.16 and 20.88, respectively) is statistically significant, (C.R.= 3.42) the difference between means is not large. Furthermore, the X^2 value for the table is only 3.31, which with 3 degrees of freedom has a probability value of about .35 an indication that the two distributions cannot be regarded as statistically independent. As far as these data go, the BI seems to differentiate Highs and Lows somewhat better at the upper end of the scale than it does at the bottom. Twenty per cent of the Highs as opposed to 13% of the Lows obtained scores of 34 or better. Even though the key developed for training does not have any marked positive value in predicting combat success, it does not afford a negative selection. That is, combat Lows do not make better scores on the test than do combat Highs. The value of the BI in predicting success in training has been demonstrated.[5]

Prediction by the Flight Aptitude Rating. The Flight Aptitude Rating (FAR) was devised late in 1942 as an aid in evaluating borderline performance in flight training, and was revised in May, 1944 for use in selection. The earlier FAR was based upon a combination of MCT and BI scores. Table 2.10 is a distribution of Highs and Lows in terms of the earlier type of FAR. The X^2 value derived from this table is 6.70, which with 4 degrees of freedom has a probability value between .10 and .20.

Prediction by a Combination of the PT and MCT. Since the PT and MCT appeared to differentiate the high and low combat groups, and since these tests are not highly intercorrelated, an attempt was made to obtain a prediction better than that obtained from either test alone by combining scores on the two tests in the most advantageous manner. A scatter plot was made of the MCT scores with the PT scores in such a way that the percentage of Highs in each cell could be determined. This is essentially the method which was used in arriving at the earlier type of FAR. The scatter plot is given in Table 2.11 and is read thus:

> "Of the 16 Highs and Lows who made PT scores between 38 and 47 and MCT scores between 61 and 79, 9, or 56%, are Highs. At the opposite corner of the table (PT scores between 14 and 23 and MCT scores between 32 and 47) only 19% are Highs."

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[5]Fiske, D. W. Op. cit.

TABLE 2.9

DISTRIBUTION OF SCORES AND CUMULATIVE PER CENTS
BIOGRAPHICAL INVENTORY: COMBAT HIGHS AND LOWS
(Preliminary Field Investigation)

854 Cases from Group of 1793

	HIGHS		LOWS	
Scores	No. of Cases	Cumulative Per Cent	No. of Cases	Cumulative Per Cent
50,51			1	100.0
48,49			3	99.8
46,47	2	100.0	1	99.2
44,45	7	99.5	2	98.9
42,43	3	97.6	7	98.5
40,41	3	96.9	6	97.0 *
38,39	11	96.1	8	95.8
36,37	22	93.2	16	94.1
34,35	27	87.4	15	90.7
32,33	11	80.4	24	87.5
30,31	22	77.5	12	82.4
28,29	16	71.7	28	79.9
26,27	20	67.5	37	73.9
24,25	24	62.3	35	66.1
22,23	33	56.0	26	58.7
20,21	31	47.4	37	53.2
18,19	23	39.3	28	45.3
16,17	21	33.2	43	39.4
14,15	20	27.7	34	30.3
12,13	19	22.5	17	23.1
10,11	18	17.5	23	19.5
8, 9	8	12.8	24	14.6
6, 7	6	10.7	12	9.5
4, 5	17	9.2	5	7.0
2, 3	6	4.7	8	5.9
0, 1	6	3.1	5	4.2
-2,-1	4	1.6	8	3.2
-4,-3			2	1.5
-6,-5	1	0.5	3	1.1
-8,-7	1	0.3	1	0.4
-10,-9				
-12,-11			1	0.2
Total	382		472	

*Cutting points used in collapsing these distributions for computations of chi-squared are indicated by lines.

TABLE 2.10

DISTRIBUTION OF GRADES AND CUMULATIVE PER CENTS
FLIGHT APTITUDE RATING: COMBAT HIGHS AND LOWS
(Preliminary Field Investigation)

667 Cases from Group of 1793

	HIGHS		LOWS	
Letter Grade	No. of Cases	Cumulative Per Cent	No. of Cases	Cumulative Per Cent
A	74	100.0	110	100.0
B	70	72.2	79	72.6
C	68	45.9	115	52.9
D	41	20.3	63	24.2
E	13	4.9	34	8.5
Total	266		401	

TABLE 2.11

PREDICTIONS BY COMBINATIONS OF PT AND MCT*

641 Cases from Group of 1793

		PT SCORES				
		14-23	24-31	32-37	38-47	Total
MCT Scores	61-76	1/4 25%	15/30 50%	33/52 64%	9/16 56%	58/102 57
	55-60	4/12 33%	58/114 51%	27/57 47%	5/17 29%	94/200 47
	48-54	12/36 33%	52/127 41%	15/44 34%	3/12 25%	82/219 37
	32-47	5/26 19%	18/70 26%	1/18 6%	1/6 17%	25/120 21
	Total	22/78 28%	143/341 42%	76/171 44%	18/51 35%	259/641 40

*The figures in each cell are: No. highs/total no. in cell.
Percentage of highs

The scores on each test were arbitrarily given in four score ranges to provide maximum numbers in the separate cells and maximum differentiation between the cells with respect to percentage of Highs. The numbers in some of the individual cells are much too small to allow attaching much significance to the resulting percentages. Therefore, only general trends can be noticed with any profit. There is a faint suggestion that the Highs are chosen from those who make somewhat lower than top scores on the PT but who do make scores in the top interval in the MCT. The cells in which the percentages of Highs are greater than 40% are enclosed in a heavy line. If only those cases who fall within this area had been selected, the result would have been as follows:

	High	Low	Total
Selected	194	202	396
Excluded	65	180	245
Total	259	382	641

In simple language, nearly half of the Lows would have been excluded at the expense of only one quarter of the Highs.

The question remains whether selection by the MCT or PT alone would have been as efficient as selection by the PT and MCT combined. In order to answer this question, a reanalysis was made of the data underlying Table 2.11 to show the effect of selection on the MCT alone under the condition that at least the same number of selected Highs would be obtained as before, i.e., 194. This necessitated selecting cases scoring 51 or above on the MCT. The result was as follows:

	High	Low	Total
Selected	201	241	442
Excluded	58	141	199
Total	259	382	641

From this table it can be seen that in order to obtain at least 194 highs, 442 men from the total group would have to be selected, as contrasted with only 396 men when both the PT and MCT are used. It may be concluded that selection on the MCT alone would be less efficient than selection on both the MCT and PT. A similar conclusion can be made for the PT, where the selection would be even less efficient than that on the MCT alone; in fact, the selection would have to be made from the middle of the distribution. These studies on the predictive efficiency of the tests should be considered only suggestive. The results of more definitive prediction studies will be presented in Chapter VI.

CHAPTER III

LARGE-SCALE COLLECTION OF DATA IN PACIFIC OCEAN AREA

Introduction

The preceding chapters have described the preliminary investigations which were directed towards the development of adequate methods of identifying and describing criterion groups of successful and unsuccessful Navy pilots. As a result of these exploratory studies, it had been concluded that:

1. By means of a "nomination technique" it was possible to identify, with substantial consistency, groups of "good" and "poor" Navy pilots in terms of their general acceptability to their fellow pilots.

2. It was possible to obtain information on the reasons as to why particular pilots were nominated for the High or the Low groups.

3. The reasons given for nominating pilots as High or Low were an essential part of the criterion data in that they might make possible the designation of criterion sub-groups in which prediction might be more efficient than the prediction of the major criterion groups (Highs and Lows).

4. There was evidence that the major criterion groups were differentiated by certain predictors (psychological tests and other variables).

The data collected in these preliminary studies had a number of limitations:

1. Not all the cases had been collected by the same set of procedures.

2. The size of the sample was judged to be too small for the types of analyses contemplated. In particular, search of APB test scores (scores, answer sheets, etc.) revealed too few cases in which complete predictor data could be found. This was due to the fact that a large number of the criterion cases had passed through Naval aviation training before selection testing had been established on a systematic scale.

3. Not all of the cases had been collected in combat areas, and it was felt that data collected in the continental United States might suffer from errors both of sampling and of authenticity.

4. In preliminary investigations little attention had been paid to the proportionate sampling of pilots in the various types of Naval aviation activities (e.g., carrier-based vs. land-based, single-engine vs. multi-engine).

Despite these limitations, the results of the preliminary studies seemed promising enough to warrant the collection of data on a much larger scale. The considerations which produced the decision to send several H(S) representatives to the Pacific Ocean Area (POA) and which influenced design of this final study were as follows:

1. It was felt that the data should be collected near the scene of combat operations because a better sample of respondents could be secured there and because the nominations in the combat area would presumably be more "valid" than those obtained within the continental limits:

   a. Comdr. Jenkins' previous trip to the POA had convinced him that the responses made there were in general more free and less restrained than in the States.

   b. Samples of respondents obtained in the States would be more biased and selected than those in the combat areas. Stateside samples might, for example, contain disproportionate numbers of combat-fatigue pilots and less successful performers.

   c. Experience had shown that it was difficult to obtain groups of returned pilots at reclassification centers for a period of time sufficient for careful interviewing.

2. There was an element of urgency in the situation. In November 1944 the progress of the war was such that its successful conclusion was already in sight, though dimly. Time was of the essence in obtaining a large quantity of data before the end of the war. Fortunately, at the time when the data were collected Naval combat operations were as intense as at any time during the war; it is probable that more Navy pilots were engaged in combat during the first half of 1945 than at any other time.

3. Information on test scores, etc., in the APB was more complete for recent graduates than for those who had received their wings, say, during 1941 and 1942. It was therefore important for the purposes of the study to obtain as many nominations as possible for recent graduates who were finishing their first tours of duty in combat.

4. It was necessary to maximize the size of the criterion groups.

   a. It was desired to build up, for future research purposes, as complete a file as possible of Naval aviators who had been in combat with an indication of whether they were regarded as "wanted" or "not wanted" by their fellow pilots.

   b. For purposes of statistical analysis a large N was necessary in order to make detailed breakdowns of the cases, to control all relevant variables adequately, and to allow maximal confidence in the results.

c. It was planned to make intensive studies of particular groups of cases -- e.g., all personnel in selected air groups. A large N was necessary to insure maximal coverage of the groups to be studied.

5. It was desired to obtain data on pilots in single-engine and in multi-engine activities in proper proportions. There was no exact knowledge of the relative proportions of these types in the combat area but the original specification called for collection of data from single-engine and multi-engine respondents in the ratio of 3 to 2.

Steps were taken in the fall of 1944 to have four H(S) psychologists ordered for an extended tour of duty in the POA. The four men finally chosen for this duty were:

Lt. Chester C. Bennett
Lt. Comdr. Verne W. Lyon
Lt. John W. Macmillan
Lt. William McGehee

Preliminary work in the Aviation Psychology Branch

Before the field investigators departed for the Pacific, they were ordered for several weeks' temporary duty in BuMed for the purpose of receiving their instructions and discussing the procedures to be used in obtaining data. (Lt. Bennett had been on permanent duty in BuMed since May 1944 and had taken part in the development of the procedures.) At this time the psychologists in the central office had succeeded in defining a set of categories into which free-response nomination material could be reliably coded, and had agreed on the basic procedure in obtaining nominations by the individual interview technique. (See Chapter II.) In the meantime, however, no agreement had been reached on the question of using a "group nomination" technique or on the matter of possible "checklists" in obtaining reasons for nomination. Since the group nomination technique had not been given extensive trial, there was no guarantee that it would yield results comparable to those obtained in individual interviews. It was therefore decided to continue the use of individual interviews until further trials could be made of the group technique.

Consideration of "Trait Checklists" and "Stimulator cards." The argument over the possible use of trait checklists in obtaining reasons for nominations revolved mainly on the question of whether the responses on a checklist would reflect the dramatically outstanding traits of a pilot or whether the responses would represent merely perfunctory characterizations. It was believed that in a spontaneous account of his reasons for nominating a particular pilot a respondent was likely to refer to the dramatically true and vivid characteristics of a pilot (whether in the High or the Low group). It was feared that with the use of a checklist this dramatic quality of characterization would be lost and that the criterion groups thereby established

particular categories would not be as pure as was desired. For example, a respondent might be tempted to check the category "Poor mixer-social recluse" if this were to any degree true of his nominee, even though this was neither an outstanding trait of the pilot nor a valid reason for nominating him in the Low group. At the same time, it was realized that a checklist would accomplish two things: first, it would facilitate the large scale collection and analysis of data by eliminating the need for protracted interviews and for coding of free responses; secondly, it would allow a more complete exploration of the traits of High and Low nominees. For example, correlations between the categories could be computed and a factor analysis could be made to determine the fundamental patterns of traits necessary for success in terms of the criterion being developed.

As a first step towards the use of a checklist, a series of 14 "stimulator" cards was devised. Each of these cards contained, on one side, a statement which might apply as a reason for giving a nomination for the High group, and on the reverse side, the presumed opposite of the statement as a possible reason for a Low nomination. The statements appearing on the stimulator cards are given in Appendix 3-A. It was planned to ask the respondents, after they had given each of their nominations, to look over the cards and pick out those statements which applied to the nominee. They would then be encouraged to report specific examples of the nominee's behavior as supporting evidence for picking out each card. The resulting responses would then be coded in the same way as free-response material. It was thought that the stimulator cards would be particularly valuable for use with those respondents who tended not to express themselves verbally in an adequate manner. It was also hoped that use of the stimulator cards would facilitate classification of responses, and thus the nominees, into sub-categories. The "stimulator" cards represented a compromise between the "free response" method and a "checklist" method. It was thought that the use of the stimulator cards would be, in a sense, a guarantee that each nominee had been considered with respect to each of a number of characteristics. On the other hand, the atmosphere of the interview was to be such as not to impose any restrictions on the free response of the individual being interviewed. The stimulator cards were to be used only <u>after</u> the respondent had given his free response.

<u>Other Considerations raised during Indoctrination Period</u>. During their period of temporary duty in BuMed, the four field investigators practiced the prescribed methods of obtaining data by staging sample interviews. They also gained experience in coding free response materials into the categories developed by the APB in the previous months, in order to familiarize themselves with the problems involved in this coding procedure. Each member of the APB was encouraged to write a memorandum on his personal views concerning what data should be obtained in the POA (in addition to the basic nomination material), how it should be obtained, and other matters. A brief abstract of these opinions may be given here:

1. Several members believed the investigators should confine their efforts to getting criterion data and that clinical and other special studies would only retard the accomplishment of the main purpose of the mission.

2. Other members believed additional clinical studies should be made and had quite specific ideas on how such studies should be conducted. At one extreme, certain members suggested that intensive clinical interviews should be conducted, delving into the pilot's background, personal history, likes and dislikes, vocational plans and aspirations, etc. At the other extreme, it was thought by some that specifically clinical interviews should be avoided but that observations should be made by participation in social activities and informal conversations with the pilots. There was a difference of opinion on the extent to which clinical interviews should be structured on the basis of an interview aid.

3. It was suggested that interviews be conducted to explore the pilot's opinions on the value of their aviation training as a preparation for combat. It was also suggested that training problems might be used as a springboard for discussion of the pilot's personal problems and characteristics.

4. There was considerable difference of opinion as to whether the investigators should attempt to collect quantitative data with reference to any hypotheses on predictive items they might develop.

5. One member suggested the use of a technique developed by the AAF to determine factors making for combat success. To quote from his memorandum:

> "After an encounter with the enemy, the combat team is assembled informally, without superior officers, for a discussion of the member's experiences during the engagement. The discussion leader starts off with a question directed towards one of the team members, asking him what he did during the fight. The aim of the discussion is to catalog the role of each member of the team in the engagement. One introductory statement might be that a 'Gallup Poll' of pilots shows that teamwork is judged to be the most important element of combat success...., If we could get such pictures, agreed on by all team members, for three or four encounters, I believe we would have something which we could use to portray to cadets in training, at least, the types of things they might be expected to do in combat. Such a method might also lead to better understanding of the meaning of combat success and failure, of leadership, and of heroism, defined in terms of the actual behavior in the combat situation of leaders, heroes, 'duds,' followers, 'old reliables,'" and so on ...."

These various points of view were taken into consideration in setting up the procedures for the first phase of the investigation.

Procedures Employed in Phase I Investigation. The collection of data during the first part of the tour of the four investigators in the Pacific

Ocean Area has been termed "Phase I" of the large scale collection of combat criterion information. Based on work in the APB, and on the discussions involving the four field investigators and APB personnel during the indoctrination period, detailed procedures for use in the field were worked out. These procedures were quite similar to those which had been used in the earlier work described in Chapters I and II, in that they involved the use of an individual interview with each respondent. The major departure from procedures previously employed was represented by the use of the stimulator cards, discussed above. In addition, more formalized procedures for collecting the data were instituted.

In brief, printed forms were prepared on which the respondent was to indicate his own name and associated information, and the name, rank, branch of service, squadron, and specialty of the men nominated. Furthermore, depending on whether a free response or the stimulator cards were used, opportunity was given for the respondent to indicate the reasons for the nomination. (If the stimulator cards were used, the interviewer recorded the respondent's remarks.) The interviewer also kept a running account of the interview.

The forms for indication of "High" nominees were called "A sheets"; the forms for "Low" nominees "B sheets." These sheets are presented as Exhibits A and B. It will be noted that the forms provided for separation of information regarding name of respondent, name of nominee, and reasons for nomination; these elements of information were returned to the APB in separate envelopes, to protect the confidential nature of the information.

The detailed methodological instructions which the POA men carried with them are given in Appendix 3-B. They also took with them the following statement of their basic mission, agreed upon by all members of the APB:

> "The basic mission of the 4 men assigned to the Pacific Area is concerned with the employment and improvement of the method of obtaining combat criterion data currently in use. They are to obtain as many nominations of Highs and Lows as may be consistent with sound procedure. They are further to gain -- and to forward to APB -- all possible insights into the meanings of the categories to the pilots and suggestions for revising either the categories or other phases of the method. (No actual changes in the basic method will be made, however, except as instructed by APB. This is obviously required in the interests of uniformity.)
>
> It is further desired that the 4 representatives remain constantly alert to opportunities for clinical study of the pilots, their social interplay, their motivation, their orientation in regard to the war, their pre-war and post-war vocational planning -- and the like. This clinical study should not involve the use of scales, tests, or forms

COMBAT CRITERION DATA SHEET
NAVMED-500 (10-44) A- 10

Date

Your Name (Last) (First) (Middle)	File No.

Rank	Branch	Present Squadron	Specialty

(1) Name (Last) (First) (Middle)

Rank	Branch	Squadron	Specialty

A- 10

File No. (Do not write here)

(1) Reason A- 10

16-41783-1

Exhibit A

(2) Name (Last) (First) (Middle)

Rank	Branch	Squadron	Specialty

A- 10

File No. (Do not write here)

(2) Reason A- 10

COMBAT CRITERION DATA SHEET
NAVMED-500 (10-44)

B- 16

Date

Your Name (Last)	(First)	(Middle)	File No.
Rank	Branch	Present Squadron	Specialty

(1) Name (Last) (First) (Middle)

Rank	Branch	Squadron	Specialty

B- 16

File No. (Do not write here)

(1) Reason

B- 16

16-41783-1

Exhibit B

(2) Name	(Last)	(First)	(Middle)

B- 16

Rank	Branch	Squadron	Specialty

File No. (Do not write here)

(2) Reason

B- 16

not approved by APB. Such written records as may result should be protected with scrupulous care and forwarded to APB by confidential mail. The aim of such study should ordinarily be directly relevant to the problems of selecting, classifying or training pilots. In the main, it is assumed that the clinical reports returned to the APB will (1) point to areas explorable through BI items and suggest hypothesis for such items, or (2) improve our knowledge of the pilot and his working environment, or (3) cast light upon the significance of the nominations that are being submitted."

The Field Investigation, Phase I

Assignments of Field Investigators. The four field investigators had left Washington by 31 October 1944 and arrived at ComAirPac, Pearl Harbor about three weeks later. On 30 November 1944 they were each given orders for a short period of "indoctrination" in combat areas prior to their eventual return to ComAirPac for further orders. During this period, the four officers were attached to the following activities:

Bennett .... Naval Air Base, Saipan (12 Dec. 44 -- 13 Jan. 45)
Bennett .... Naval Air Base, Tinian (13 Jan. 45 -- 26 Feb. 45)
Lyon .... USS Ticonderoga (3 Dec. 44 -- 27 Jan. 45)
USS Hancock (27 Jan. 45 -- 9 Mar. 45)
Macmillan .. USS Langley (24 Dec. 44 -- 10 Mar. 45)
McGehee .... Fleet Air Wing 10, Morotai, N.E.I. (14 Dec. -- 12 Jan. 45)
Fleet Air Wing 10, Tacloban, Leyte, P.I. (12 Jan. 45 -- 23 Jan. 45)
Fleet Air Wing 17, USS Tangier, Leyte to Lingayen Gulf -- (23 Jan. 45 -- 27 Jan. 45)
Fleet Air Wing 17, Hdqtrs., Luzon (4 - 11 Feb. 45)

The investigators used this period of duty to contact several air groups and wings for intensive study. The specific squadrons of groups studied by each investigator, with the number of formal interviews accomplished, are as follows:

Bennett: VB-1; VPB-151; VPB-150; VPB-216. (91 pilots interviewed)
Lyon: CAG-80. (120 pilots interviewed)
Macmillan: CAG-44; CAG-23. (28 pilots interviewed)
McGehee: VPB-20; VPB-71; VPB-101; VPB-104; VPB-137. (65 pilots interviewed)

For various reasons, the investigators were not able to interview all pilots in all of these squadrons or groups, but the coverage was almost complete in at least several cases. A total of 304 pilots was interviewed by the prescribed procedures. A number of supplementary interviews, some of them "clinical" in nature, were given to check the results of the formal interviews and to explore other problems. It should be added, of course, that the investigators were able to become well acquainted with many of the pilots and to observe them in their everyday social behavior.

General Evaluations of the Procedure. Aside from the combat criterion data themselves, which the investigators mailed to BuMed, the outcomes of Phase I of the investigation may be evaluated from two kinds of documents. The informal letters sent in by the investigators give information on the problems of obtaining data, administrative and otherwise; applying the nomination technique; and miscellaneous matters. The reports made by the several investigators to the Staff Medical Officer, ComAirPac, at the conclusion of their indoctrination tour of duty summarize their observations. Excerpts from letters of the investigators are presented in Appendix 3-C. The formal reports of the investigators are presented in Appendix 3-D.

In general, as is evident from the excerpts from letters presented in Appendix 3-C, with a few exceptions, the cooperation of pilots and their commanding officers was satisfactory. However, with reference to specific aspects of the procedure, a number of problems arose.

Among the administrative difficulties encountered by the field investigators were the following:

1. Difficulty in finding suitable places for conducting private interviews.

2. Lack of cooperation on the part of some commanding officers, who at first refused to allow the investigator to proceed on the grounds that the men were too "tired" and "jumpy" to be bothered about a study of the type being conducted.

3. Transportation difficulties, particularly where transportation from one ship to another in the same area was involved.

4. Unfortunate phrasing of orders. For example, McGehee was ordered to a Fleet Air Wing but found the component squadrons of the wing scattered widely and moving rapidly. He reported that he understood the Wing "has little authority over assignment of personnel, etc. to these squadrons." He believed assignments should be made in the following manner:

"a. To specific ship or ships, i.e., CVs or CVPs or seaplane tenders;

b. or to specific number of squadrons (with luck you can cover your work in a big boat squadron in two weeks);

c. or to Commander Air Force X Fleet, who then could send you from squadron to squadron."

Furthermore, it had been hoped by the APB research staff that the interviewing procedures initially promulgated would "stick." Shortly after the field investigators began operations in the Pacific Ocean Area, however, several circumstances forced a reconsideration of the procedures then in use. In the first place, the field investigators wrote that the individual interview procedures were so time-consuming that it might be impossible to meet their quotas in view of the relatively short time provided for the study, -- the fast pace

of combat operations, and the rapid turnover of combat aviation personnel. Secondly, it was reported that the stimulator cards usually failed to elicit significant information beyond that obtained in the initial free response situation, that the stimulator cards were in any case ambiguous and subject to varying interpretations, and that they overlapped considerably. The responses to the stimulator cards frequently appeared unrelated to the statements on the cards. At least two of the field investigators abandoned the use of the stimulator cards on their own initiative, and only one held out for their continued use.[1]

Several of the investigators independently adopted a plan of obtaining data by assembling respondents in a group and asking them to write nominations and reasons for nominations on standard forms. It appeared from this work that the fears formerly held that nominations obtained by a group technique would lack authenticity were unfounded. At any rate, nominations were made under this system quite as positively, firmly, and even bluntly as under the individual interview procedure.

The investigators experimenting with this technique developed check-lists of their own, usually adapting to their own purpose the lists of categories published in Aviation Psychology Technical Memorandum No. 4 (1 Dec. 1944) which had just reached them. When they were first given orders for their industrial tour of duty, the investigators understood that they were to return to Pearl Harbor for further assignment. All the men had returned there by March 14, and immediately began to compare notes, write reports, and to consider possible modifications in the procedures previously used. Formal reports of the field investigators at this stage are presented in Appendix 3-D. The investigators had agreed that the modifications might be so radical that they would require consideration by BuMed. In the interest of developing a uniform set of procedures they suggested that Capt. Jenkins be ordered to Pearl Harbor for a short period of consultation. He arrived at Pearl Harbor 11 April and stayed until 20 April to consult with the field investigators.

Development of Revised Procedures

As a result of the conferences with Capt. (then Commander) Jenkins, several major changes were made in the procedures for obtaining combat criterion data.

Of first importance was the decision to emphasize a "group" technique for obtaining nominations instead of the individual interviews. It was believed that a much larger body of material could be collected in this way at very little risk of loss in precision.

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[1]Pertinent comments of this investigator on these problems are presented in Appendix 3-C.

Secondly, the use of the stimulators was to be completely abandoned. Instead, two checklists of reasons for nomination were constructed on the basis of the categories worked out by the APB in BuMed. These lists (List A for use with pilots nominated for the High group and List B for the Low group) are shown in Appendix 3-E,b. List A contained 22 statements applicable to High pilots, while List B contained 26 statements applicable to Low pilots, the first 22 of these being the presumed opposites of the 22 statements on List A. The respondents were to indicate their reasons for nomination not only by circling the code numbers of all the checklist reasons that applied but also by indicating (with an X) not more than three of these reasons which were "outstanding." The respondents were also encouraged to make any free-response comments they cared to make. (These free-response comments were not studied in most of the subsequent analyses.)

In addition to the problems of (a) the individual interview versus the group technique and (b) the stimulator cards versus the checklists, another major difficulty had arisen in the initial phase of the field investigators' operations. This had to do with the form of the questions used to obtain the nominations.

In Phase I procedures, respondents in carrier-based squadrons were asked to give names of pilots on whom they would be willing or pleased to fly wing (Highs) and names of pilots whom they would definitely <u>not</u> want on their wing. Thus, they were in effect asked to pick for the High pilots those whom they would want as their <u>superiors</u>, and for the Low pilots those whom they would not want as their <u>subordinates</u>. Similarly, respondents in P-boat squadrons were asked to name, for the High group, men for whom they would be willing or pleased to fly as co-pilot, and for the Low group, those not wanted as co-pilots (assuming the respondent flies as plane commander.)

In studying carrier-based groups, field investigators experienced little or no difficulty in using the questions as stated above. These questions had been carefully developed in previous studies in carrier-based groups. The teamwork required in carrier-based air operations and the close interdependence of the wing leader and his wingman made the questions appear logical and meaningful to the respondents. In VP squadrons, however, the questions which were asked did not appear to make sense to the respondents. The relationship between the pilot and co-pilot did not seem to be analogous to that between the section leader and his wingman. Instead of being in any sense intimately dependent on the co-pilot, the patrol plane commander regards his co-pilot as a sort of apprentice. In picking a "High," the respondents found it difficult to imagine themselves as co-pilots.

The following quotations are made from letters of one of the field investigators (McGehee) working with a P-boat squadron:

> "One thing that has come from the skippers in criticism of our techniques is the use of the term 'co-pilot' in selection of the Highs. They seem to think we miss the boat in getting what we want there, as a 'co-pilot' job is a hard one for plane commanders to imagine occupying. One skipper suggested

> phrasing the question in terms of whom he would like to have in the plane with him to bring the plane in, in case he was incapacitated, or to phrase the question in fighter terminology as flying wing or lead on a strike where two or more bombers go in."
>
> ...."From talking with both the plane commander (P.P.C.'s) and co-pilots, it is my opinion that the relationships between the P.P.C.'s and the co-pilots is in a different order from the relationship between a wing leader and his wingman in VF, VTB, or VB operations. The co-pilot is essentially an apprentice; he handles the plane only when the P.P.C. directs. (Good P.P.C.'s give their co-pilots definite opportunity along this line.) The wingman in VF operations, while dependent on his section leader, is nevertheless responsible for his aircraft. He is more independant than the co-pilot."

In view of the considerations brought forth by the field investigators, the revised procedures developed at Pearl Harbor, April 1945, incorporated the suggestion that the P-boat respondents be asked to pick, for the High group, the men most wanted as co-pilots in a situation when the respondent is incapacitated and must turn the controls over to his co-pilot. Accordingly, the question was changed as follows:

> "Assume that you have been incapacitated while on a combat mission and that you must turn the control of your plane completely over to your co-pilot. In this situation, of all the men you know in Naval aviation, what man would you be best satisfied to have take over the controls to complete the mission and bring you back to your base?"

The question asked for nominating the Low group man was not changed in any essential way. However, it was apparently assumed that the question would imply, by a sort of carryover from the High group question, that the individuals nominated would be those definitely not wanted as co-pilots in a critical combat situation.

Summary of Revised Procedures. The procedures developed for use in obtaining nominations from groups of respondents involved, as noted previously, a check sheet in terms of which reasons for nomination could be designated; and a form for use by the respondents in recording their nominations and associated information. Briefly, the respondent indicated on this latter form, in addition to his own name, the name of the nominee, and the checklist numbers of the reasons for the nomination, High or Low. (Separate forms were used for recording High and Low nominations, respectively.) In addition the respondent was asked to indicate the three most important reasons for nominating the man in question (either as a High or as a Low). As is evident from examination of the forms, appropriate measures were taken to protect the confidential nature of the nominations during transmission back to the APB, through providing for sending names and nomination information in separate envelopes, identified only by serial or "matching" numbers.

The following documents pertinent to the revised set of procedures for obtaining combat criterion data are shown in Appendix 3-E:

1. Basic instructions for collecting criterion data, April 1945 .... Appendix 3-E,a.

2. A List and B List (reasons for nominating pilots for High and Low groups).... Appendix 3-E,b.

3. Blank forms for use by respondent in nominating two pilots for the High group and two pilots for the Low group and indicating their reasons for nominating these men .... Appendix 3-E,c.

4. Basic tasks for POA men, April 1945 .... Appendix 3-E,d.

The basic mission of the field investigators as indicated in Appendix 3-E,d was to collect by the prescribed methods, a large number of cases as rapidly as possible. Time and opportunity permitting, they were also to complete several studies on at least two air groups per investigator:

a. Using a technique previously tried out by Capt. Jenkins during his second tour of duty with Air Group 16, they were to obtain data on the relative importance of the categories.

b. They were to "obtain sorts as to the estimated frequency of occurrence of categories under instructions aimed to establish the relative frequency that is believed to obtain among the categories rather than the pilot population at large." (Actually, this was never done.)

c. They were to "obtain sorts to indicate the amount of trouble respondents have had with each of the categories in the combat area." (This project also was never attempted.)

The Field Investigation, Phase II

The investigators were given orders which permitted them freedom to plan their own itineraries in the forward combat areas. They traveled alone or in pairs, visiting air groups and squadrons of all types for brief periods (three or four days on the average). At all times the "group technique" was used in obtaining nominations. During the remainder of their tour of duty in the Pacific, from April to June 1945, they were able to obtain nominations from a total of 2872 respondents. A summary of the squadrons visited and the number of pilots interviewed are presented in the following chapter. The investigators have stated their belief that they covered practically all the combat-experienced pilots available in the forward combat areas of the Pacific at that time. There was only one major gap in coverage; the investigators were not able to obtain access to a number of VPB squadrons stationed in Okinawa. Thus, they easily surpassed the goal of 1500 respondents set for single-engine pilot respondents but did not quite achieve the goal of 1000 multi-engine respondents.

The nominations obtained during this period have been treated as a unit since they were all obtained by the so-called "checklist" method. These "checklist" data, which have received more adequate analysis and treatment than any of the other sets of data, will be discussed in the following chapters.

The investigators did not have time or opportunity to complete any of the special subsidiary studies, with one exception. In several carrier and multi-engine squadrons, a study was made of the judged importance of the categories, both on the "A" List and the "B" List. The results of this study will be discussed in Chapter V.

The investigators completed their collection of data by the end of June, were detached from ComAirPac 7 July, and had returned to the continental limits by the end of July.

Techniques of Preparing and Assembling Raw Data

Most of the major statistical analyses to be reported in Chapters IV, V, VI and VII were performed on the basis of decks of IBM punched cards which were prepared from the raw field data and from material already available in APB. The procedures which were used in processing the raw data to yield the final decks of punched cards are described in Appendix 3-F. These procedures are spelled out in detail only for the raw data yielded in what has been called here Phase II of the field investigation. The procedures for handling other sets of raw data (e.g., from the preliminary field investigations described in Chapter II and from Phase I of the major field investigation) are not essentially different from those which are described in the above-mentioned appendix.

Other materials which are relevant to procedures in processing data are the following:

Raw data sheets used by field investigators in Phase I of the major study: See Exhibits A and B, this chapter.

Raw data sheets used by field investigators in Phase II of the major study: See Appendix 3-E, c.

Combat Criterion Data Code Card (NAVMED 791 -- Rev. 6-45) used in transcribing raw data preliminary to punching: See Appendix 3-G.

Code C, code for the punched card file (Code C deck) used for preliminary identification of the nominees: See Appendix 3-H.

Code E, code for the punched card file (Code E deck) containing a summarized record of the number of nominations (over-all and by specific "reasons") for each nominee, in addition to test scores and AvCad training data, when available: See Appendix 3-I.

Code A, code for the main alphabetical file maintained by APB for the test scores and training status of all aviation cadets: See Appendix 3-J.

CHAPTER IV

ANALYSIS OF NOMINATIONS

It was considered that the data from Phase II of the field investigation were relatively definitive in nature, and warranted extensive statistical analysis. This chapter will be devoted to the results of the analysis of nomination data per se.

Respondents

It will be recalled that an effort was made to interview, by the group technique, all members of squadrons visited who had sufficient combat experience to observe fellow pilots in action. A grand total of 2872 pilots was interviewed, including 2047 pilots of single-engine planes, and 825 pilots of multi-engine planes. An indication of the air groups interviewed is presented in Table 4.1. It will be noted that both carrier based and land based pilots were covered, and that the respondents included both Navy and Marine officers.

While specific data on completeness of coverage could not be determined for air groups visited in Phase II of the investigation, the field investigators felt that the coverage of squadrons and air groups to which they were assigned was almost as complete as possible. Data on this question are available for one air group (Air Group 80) contacted by Captain Jenkins during early stages of the work. These figures, which are presented in Table 4.2, can also be considered fairly representative of the coverage during Phase II of the program. Inspection of this table indicates that over 75 per cent of the pilots in this air group as a whole, and over 75 per cent of the pilots in each squadron were interviewed. It should be recalled that officers in an air group who had not had appreciable combat experience were not interviewed, and that other pilots could not be interviewed because of sickness, or for other reasons. Therefore, it was not practicable to obtain 100 per cent coverage of all air groups to which investigators were assigned.

The average number of nominations per nominator, as indicated in Table 4.2, is slightly under 4, since some nominators (or respondents) did not nominate two men for both the High and the Low groups, respectively. Since certain individuals were nominated by two or more respondents, the average number of nominees per nominator is in the neighborhood of 2, the average number of nominations per nominee being 1.8 for the group as a whole, varying between 1.7 and 2.1 over the three squadrons.

Nominees

From the group of 2872 respondents, a total of 4325 men were nomi-

TABLE 4.1

DISTRIBUTION OF RESPONDENTS BY AIR GROUP

A. SINGLE ENGINE PILOTS

1. CARRIER BASED

(a) CV GROUPS

	LOCATION	NO. OF PILOTS INTERVIEWED	
82	BENNINGTON	127	
84	BUNKER HILL	104	
9	YORKTOWN	67	
10	INTREPID	125	
83	ESSEX	135	
90	ENTERPRISE	34	
17	HORNET	136	
85	SHANGRI-LA	123	
6	HANCOCK	131	
			982

(b) CVL GROUPS

46	INDEPENDENCE	45	
47	BATAAN	49	
34	MONTEREY	48	
30	BELLEAU WOOD	46	
45	SAN JACINTO	42	
			230

(c) CVE GROUPS

	25	CHENANGO	33	
	35	FPRC	44	
	33	FPRC	34	
	1	FPRC	40	
	87	FPRC	44	
	94	FPRC	44	
	97	FPRC	41	
	93	FPRC	44	
	13	ANZIO	38	
MCAG	2	GILBERT IS.	38	
				400
		SUB TOTAL		1612

2. LAND BASED (MARINE)

VMF 225	GUAM	42
VMTB 131	GUAM	34
VMF(N) 534	GUAM	15
VMF 122	PELELIEU	35
VMF 121	PELELIEU	20
VMF(N) 541	PELELIEU	20

TABLE 4.1 (Continued)

VMSB 142	ZAMBOANGO	41
VMSB 243	ZAMBOANGO	41
VMSB 236	ZAMBOANGO	35
VMF 115	ZAMBOANGO	23
VMF 218	ZAMBOANGO	35
VMF 611	ZAMBOANGO	32
VMSB 341	ZAMBOANGO	35
VMTB 242	TINIAN	27
		425
	TOTAL	2047

B. MULTI-ENGINE PILOTS

1. VPB SQUADRONS

117	MINDORO	36
15	SAIPAN	46
149	SAMAR	28
71	SAMAR	22
25	JINAMOC	32
118	TINIAN	46
116	TINIAN	51
133	TINIAN	24
22	ULITHI	53
205	SAIPAN	48
102	TINIAN	46
20	TAWI TAWI	42
119	CLARK	51
104	CLARK	41
28	SANGLEY POINT	36
17	LINGUYAN	18
151	TINIAN	14
106	PALAWAN	51
111	PALAWAN	39
108	TINIAN	40
	SUB TOTAL	764

2. MARINE

VMB 611	ZAMBOANGO	14
VMB 612	IWO JIMA	47
	SUB TOTAL	61
	TOTAL	825

SINGLE ENGINE	2047
MULTI-ENGINE	825
GRAND TOTAL	2872

nated.[1] Of these 4325 pilots nominated, 4103 represented "unmixed" cases, i.e., they were nominated either for High or for Low by one or more respondents, but were not nominated both for High and Low by different respondents. Of this number 2274 men (or 55.4 per cent of the unmixed cases) were nominated for High, 1829 (44.6 per cent) being nominated for Low, the greater incidence of High in comparison with Low nominees being statistically significant.

Proportion of Men on Roster Nominated. Data from Air Group 80, and from a representative sub-sample of the total sample of 4325 cases, indicate that approximately 50 per cent of the pilots in a given squadron were nominated by their squadron mates. A breakdown for Air Group 80 is presented in Table 4.2. Reference to this table indicates that the number of nominees is in excess of the number of pilots in the Air Group. This results from the fact that many of the nominees were outside the air group in question. As a matter of fact, only 81 of the men nominated were on the Air Group roster, i.e., only 54 per cent of the men on the roster were nominated. Twenty-four other nominees were former squadron members. One hundred forty-nine of the nominees, or 59 per cent of the nominees, came from outside the squadron.

These figures are in line with results of another analysis of data collected from 10 selected air groups, included in the Phase II program, which will be discussed in greater detail later in this chapter.[2] In this study it was found that approximately 50 per cent of the 1094 pilots on the rosters at the time data were collected were nominated, and that approximately 48 per cent of the 1311 pilots who were on either these rosters, or on the rosters for the same air groups six months previous to the collection of data, were nominated.

Proportion on Squadron Rosters Nominated High and Low, Respectively. With reference again to the data from Air Group 80, inspection of Table 4.2 indicates that while over half of the nominees represented men outside the squadron, there was little difference in the ratio of High to Low nominations for squadron members and outsiders, respectively. Although not necessarily in contradiction to this finding, analysis of data from the 10 air groups studied intensively indicated that the incidence of Lows among men only on the roster six months previous to the investigator's visit was relatively large; in fact the number of Lows appearing only on this first roster (46) exceeded the number of Highs (26). Apparently the

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[1] In addition, there were 512 nominations for which the nominee could not be identified. These nominations were therefore discarded. It should be noted, however, that some of these "unidentified nominees" probably are represented in the group of 4325 identified officers, having been nominated by other respondents and identified in these terms.

[2] The 10 air groups for which data were examined were: 6, 9, 10, 17, 25, 30, 46, 47, 82, and 83.

TABLE 4.2

ANALYSIS OF NOMINATION DATA -- AIR GROUP -- 80

		VF-80	VB-80	VT-80	TOTAL
No. Men on Roster.		95	28	27	150
No. Men Interviewed (No. respondents)		73	22	23	118
No. Nominees		168	38	48	254
No. Nominations.		285	81	92	458
Avg. No. of Nominees per Nominator. . . .		2.3	1.7	2.1	2.2
Avg. No. of Nominations per Nominator. .		3.9	3.7	4.0	3.9
Avg. No. of Nominations per Nominee. . .		1.7	2.1	1.9	1.8
No. Men on Roster Nominated	High	20	8	8	36
	Low	23	4	6	33
	Mixed	9	1	2	12
No. Former squadron members nominated . .	High	2	1	2	5
	Low	5	9	5	19
	Mixed	--	--	--	--
No. Outsiders nominated. .	High	54	9	13	76
	Low	55	6	12	73
	Mixed	--	--	--	--

men disappearing from the squadron during the six-month period tended to be the less acceptable performers.[3]

This fact may, however, explain why the incidence of Lows among the 10 air groups under consideration was markedly lower than for the entire group of 4325 cases. For the 10 air groups studied, Low nominees amounted to only 32.4 per cent of the total, as compared with 42.4 per cent for the total of 4325 cases, and 40.2 per cent of the single-engine pilots in the total sample.

If, as appears to be the case, Low nominations tend to be given for men outside the respondent's air group, or for men who were dropped from the air group a considerable time before the nomination, the lesser incidence of Lows on the air group roster, in comparison with the total sample, is understandable.[4] In other words, the lesser incidence of Low nominations given to men who were actually in active squadrons at the time of the field investigators' visit, as compared with the incidence of Lows in the total sample of nominees (which might contain anyone, whether living or dead, or whether active in combat or not), seems to indicate that Low nominations were often given to men who had been lost to combat duty because they really were poor performers. The hypothesis that the Low nominations were more often given outside the respondents' squadrons because the respondent wished to "protect" the men within his squadron cannot be easily tested, but does not seem of much validity in view of the fact that the respondents were very emphatic in mentioning Lows within their own squadrons when they actually existed. They did not seem prone to "protect" these men; rather, they hoped to be rid of them.

<u>Distribution of Multiple Nominations, Total Group</u>. Of the 4325 men nominated in the Phase II program, 1727, or approximately 40 per cent, were nominated by two or more respondents. Of these, 222, or 12.9 per cent, represented "mixed" nominations, i.e., 222 men were nominated for both High and Low. This figure represented 5.1 per cent of the total sample of 4325 pilots.

<u>Number of Nominations per Nominee</u>. The distributions of the numbers of nominations per nominee, excluding mixed cases, are presented in Table 4.3. It is evident from this table that a number of men received over 20 nominations for either High or Low, one man being nominated for High by 32 respondents. In general, 1505, or 37 per cent of the clear (or "unmixed") nominees received two or more nominations, 407 (or 10 per cent) receiving

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[3]No information was obtained as to why the Highs disappeared from the squadron; some of them were killed or were missing in action, or disappeared for various other reasons.

[4]Unfortunately, it was not readily possible to make an analysis of the nominations in these 10 air groups with respect to whether they were made from within the air groups or from the outside. It is the impression of those who worked with the data, however, that the great majority of nominations made for the men in these 10 air groups came from <u>within</u> these squadrons.

TABLE 4.3

DISTRIBUTION OF CHEMLIST NOMINEES BY NUMBER OF NOMINATIONS

9-24-45

No. of Nominations	No. of HIGHS	No. of LOWS	Total
32	1		1
31			
30			
29			
28			
27			
26		1	1
25	1	1	2
24	2	2	4
23	2	2	4
22	1		1
21	1	1	2
20	1	1	2
19	1		1
18	3		3
17	3	2	5
16	2	1	3
15	4	5	9
14	5	4	9
13	8	11	19
12	2	6	8
11	7	9	16
10	11	1	12
9	18	16	34
8	19	18	37
7	30	17	47
6	44	33	77
5	58	46	104
4	87	74	161
3	169	138	307
2	352	284	636
1	1442	1156	2598
Total	2274	1829	4103

five or more. Among these "clear" nominees, there is no general indication of a greater incidence of multiple nominations among Highs or Lows, 36.6 per cent of the Highs being nominated more than once, in comparison with 36.8 per cent of the Lows.

Distribution of Multiple Nomination by Rank. There is in general, however, a greater incidence of multiple nominations among "senior officers" (i.e., Lieutenants and above) than among "junior officers" (Lts., j.g., and Ensigns). For example, in terms of a sample of 3303 Carrier and Multi-engine pilots, 35 per cent of the 1841 junior officers were nominated more than once, whereas about 50 per cent of the senior officers (726 out of 1462 men) were nominated more than once.[5] This is in line with expectation, since senior officers would be expected to have had longer exposure to combat in company with their fellows, and thus would have the opportunity to pick up more nominations.

Nevertheless, it is of particular interest that this marked, and statistically significant difference in incidence, in terms of rank, is evident only for officers nominated for High. In this sample, of the 1907 men nominated for High, 941 were junior officers and 966 were senior officers. Only 30 per cent (or 282) of the junior officers were nominated more than once, whereas 52 per cent (or 498) of the senior officers were nominated more than once. This difference in incidence is statistically significant at well below the .01 level.[6] On the other hand, among Low nominees 41 per cent of the 920 junior officers were nominated more than once, as compared with 46 per cent of the senior officers. This difference in incidence is not statistically significant.[7]

The fact that senior officers nominated for Low received, proportionately, only slightly, and not significantly, more multiple nominations than did junior officers might suggest that senior officers, showing combat performance characteristic of Low nominees, were not in the combat area as long as senior officers nominated High, and thus did not pick up as many multiple nominations. This might have resulted from the fact that the attrition among "Low" senior officers was greater than among Highs, due to these officers being relieved of combat duty, or for other reasons, such as death. On the other hand, the "Low" senior officers may have included a greater number of recent arrivals in the combat areas.

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[5] This difference in incidence is significant at well below the .01 level of confidence, chi-squared being 69.09, with one degree of freedom.

[6] Chi-squared being 92.05, with one degree of freedom.

[7] The chi-squared being 3.28, with an associated p value, for one degree of freedom, of between .10 and .05.

Mixed Cases. Data on the mixed cases are presented in Table 4.4*

TABLE 4.4

DISTRIBUTION OF MIXED CASES BY NUMBER OF NOMINATIONS

No. of Nomin. HIGH Group	No. of Nominations for LOW Group																	Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	--	20	
11	2																	2
10	2																	2
9	1		1															2
8	2			1														3
7	1																	1
6	4	1																5
5	4	1																5
4	8	3																11
3	12	3				1									1			18
2	29	9	5	1	3													47
1	81	22	6	6	2	2	3		1	1	2						1	127
Total	146	39	13	8	5	3	3		1	1	2				1		1	223

It is evident that 81, or about 36 per cent of the cases received one Low and one High nomination; the remainder of the cases receiving multiple nominations in one or both categories. One case, for example, received 20 Low nominations and 1 High nomination, another 15 Low nominations and 3 High nominations, and two cases received as many as 11 High nominations but one Low nomination. However, only 31, or about 14 per cent of the mixed nominations, received as many as two nominations for both High and Low. The bulk of the mixed cases nominated four or more times received only one nomination opposite to the plurality of nominations received. It seems reasonable to conclude that many of the "mixed" cases actually are rather clear Highs or Lows. There is little indication that mixed cases received predominantly either High or Low nominations.

Reference back to Table 4.2 yields further information on the nature of the mixed nominees, based on data from Air Group 80. The percentage

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*Editor's note. It will be noted that the number of mixed cases in Table 4.4 is given as 223, whereas in other tables the number of mixed cases is indicated as 222. Apparently, the distributions on which Table 4.4 is based were set up after additional data on one man had been identified, rendering the officer in question a "mixed" rather than a "clear" case. This discrepancy, however, in no way alters conclusions drawn from this or other tables. Therefore, due to the nature of the raw data and the extensive labor involved in correcting the distributions, through reference to the raw data, this minor discrepancy has been allowed to stand.

of mixed nominees in this air group was 4.7, about the same percentage as for the sample of 4325 pilots. However, it is of interest that all of these 12 mixed nominees were on the current roster, i.e., were members of the squadron at the time the nominations were made. There were no mixed nominations for former squadron members, or for outsiders; perhaps because former squadron members and outsiders were known by fewer men currently in the squadron and thus collected fewer multiple nominations.

Distributions by Rank, Reserve vs. Regular Status, and Specialty. The distribution of clear cases by rank, reserve or regular status, and specialty, are presented in Table 4.5, these data being summarized in Table 4.6. Inspection of these tables indicates that 3630, or approximately 88 per cent of the 4103 clear cases, held a rank of Lieutenant or below, 2362, or over half, holding the rank of Lieutenant (jg) or Ensign. There is nothing more than a slight trend indicating a difference in incidence of High or Low nominations between Regular and Reserve officers. For all pilots, there is a higher incidence of "Lows" among reserve officers. This is due, however, to the paucity of reserve officers above the rank of Lt. Commander, and to differences in incidence of High nominations in relation to rank. Evaluation in terms of chi-squared of pooled data from the entire table (Table 4.5), would be misleading for this reason. Difference in incidence of Highs or Lows, between Regular and Reserve officers of any given rank below Commander is not statistically significant.

With reference to Table 4.5 and also to 4.6, there is indicated little difference in incidence of High or Low nominations by specialties, except with reference to the "Not Classified" category, where the incidence of Low nominations is relatively high. There is, however, an apparent trend in incidence of High and Low nominations with reference to rank, there being a higher incidence of "Junior Officers" (Lt. (jg) or lower) among Low nominees than among High nominees and conversely a higher incidence of "Senior Officers" among High than among Low nominees. With reference to data presented in Table 4.6 this trend is statistically significant, in terms of the chi-squared test, for all cases and for the subcategories "Single-Engine" and "Not Classified." However, for the "Multi-engine" category, although the incidence of senior officers is greater among High than among Low nominees, this difference in incidence does not meet the commonly accepted level of statistical significance, chi-squared being 3.42 with an associated p value of between .05 and .10. In general, however, the trend for relatively fewer high ranking officers to be included in the Low than the High group is undeniable.

Distributions of the "mixed" nominees are presented in Table 4.7. The number of cases under each rank category is too small to warrant drawing definitive conclusions. However, the incidence of mixed nominations for cases with the rank of Lieutenant appears somewhat higher than for the unmixed cases.

Proportion of all Pilots on Roster Nominated. For the group as a whole, there is no available information on the proportion of pilots, of various ranks, in all air groups studied who were nominated High or Low. Such information is available only from the analysis of the data from 10 air groups, and is presented, in tabular form, in Table 4.8.

TABLE 4.5

DISTRIBUTION OF CHECKLIST HIGH OR LOW NOMINEES*
BY RANK, RESERVE VS. REGULAR, AND SPECIALTY CLASSIFICATIONS

(From Population of 4325 Nominees, i.e., excluding "MIXED" cases) [illegible]

			SPECIALTY								Total	Total	Total
			VF	VSB	VTB	VPB	VOS	VS	VOX*	HC	H's,L's	Res.Reg	by Rank
ENS.	Reserve	High	158	25	33	91	1	8	43	88	447	1114	1135
		Low	199	57	58	93	---	6	58	196	667		
	Regular	High	4	2	1	2	---	--	--	--	9	21	
		Low	5	1	1	4	---	--	--	1	12		
LT.JG	Reserve	High	245	62	65	111	---	38	63	62	646	1193	1226
		Low	183	54	67	78	4	21	46	94	547		
	Regular	High	6	--	1	11	--	1	1	1	21	33	
		Low	2	1	4	4	---	-	-	1	12		
LT.	Reserve	High	233	61	62	207	3	15	51	114	746	1162	1369
		Low	82	42	35	110	4	13	35	95	416		
	Regular	High	20	5	9	20	--	--	3	15	72	207	
		Low	9	2	-	13	-	1	2	8	35		
LT. COMDR.	Reserve	High	33	10	18	16	1	3	10	28	119	167	365
		Low	10	5	2	13	-	7	1	10	48		
	Regular	High	48	15	16	26	1	3	9	21	139	198	
		Low	18	9	3	14	-	5	2	8	59		

TABLE 4.5 (Continued)

			SPECIALTY								Total	Total	Total
			VF	VSB	VTB	VPB	VOVS	VR	VGX*	MC	H's & L's	Res.-Reg.	by Rank
CDR.	Reserve	High	3	-	-	-	-	-	-	3	6	12	84
		Low	2	-	-	-	-	-	-	4	6		
	Regular	High	12	5	4	4	-	2	7	22	56	72	
		Low	1	1	-	7	-	-	-	7	16		
CAPTAIN	Reserve	High	-	-	-	-	-	-	-	-	0	0	6
		Low	-	-	-	-	-	-	-	-	0		
	Regular	High	-	1	1	-	-	-	-	3	5	6	
		Low	-	-	-	-	-	-	1	-	1		
	Rank Unknown	High	-	-	-	-	-	-	-	8	8	18	18
		Low	-	-	-	-	-	-	-	10	10		
TOTAL	Reserve	High	672	162	178	425	5	64	167	292	1964	3648	4103
		Low	476	158	162	294	8	47	140	399	1684		
	Regular	High	90	28	32	63	1	6	20	62	302	437	
		Low	35	14	8	42	-	6	5	25	135		

*Carrier pilots, specialty not indicated.

TABLE 4.6

SUMMARY DISTRIBUTION OF CHECKLIST HIGH OR LOW NOMINEES
BY GROSS RANK AND SPECIALTY CLASSIFICATION

4103 Cases from Population of 4325, i.e., excluding 222 MIXED cases

	Junior Officers*		Senior Officers*		Rank Unknown		Total		Grand Total
	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	
Single Eng.**	713	740	641	266	-	-	1354	1006	2360
Multi-Eng.	262	206	296	183	-	-	558	389	947
Not Class.	148	292	206	132	8	10	362	434	796
Total	1123	1238	1143	581	8	10	2274	1629	4103
Grand Total	2361		1724		18		4103		4103

*Ensigns and Lieutenants (jg) were classified as Junior Officers; Lieutenants (SG) and above as Senior Officers.

**Single Engine includes VF, VSB, VTB, VOVS, and VCX; Multi-Engine includes VPB and VB.

TABLE 4.7

DISTRIBUTION OF CHECKLIST "MIXED" NOMINEES BY
RANK, RESERVE vs. REGULAR, AND SPECIALTY CLASSIFICATIONS

From Population of 4325 Nominees   9-24-45

		Specialty								Total	Total
		VF	VSB	VTB	VPB	VOS	VB	VCS	NC	Res. Reg.	By Rank
ENSIGN	Reserve	10	2	2	8	-	-	3	1	26	27
	Regular	-	-	-	1	-	-	-	-	1	
LT. (jg)	Reserve	19	1	8	15	-	1	2	-	46	48
	Regular	-	-	-	2	-	-	-	-	2	
LT.	Reserve	39	7	15	27	-	1	12	2	103	115
	Regular	2	2	1	6	-	-	-	-	12	
LT.COMDR.	Reserve	3	4	2	3	-	-	-	-	12	22
	Regular	5	1	1	3	-	-	-	-	10	
COMDR.	Reserve	-	-	2	-	-	-	-	3	5	7
	Regular	1	-	-	-	-	-	-	1	2	
	Unknown								3	3	3
TOTAL	Reserve	71	14	29	53	-	2	17	6	192	222
	Regular	8	3	2	12	-	-	1	1	27	

When the percentage of all pilots on the roster who were actually nominated is considered the proportion of higher ranking officers nominated for High is greater than the proportion of lower ranking officers. For example, reference to Table 4.8 indicates that 56.1 per cent of all Commanders and Lt. Commanders on the roster were nominated High, as compared with 13.6 of all Ensigns on the roster. <u>However, the data for the Low category are strikingly different.</u> When all pilots are considered, the percentage of all pilots of a given rank nominated for Low is relatively constant, from Ensign on up through Lt. Commander and Commander. Accordingly, of course, the percentage of lower ranking pilots who are not nominated at all is greater than the percentage of higher ranking pilots who are not nominated.

This might suggest that, with reference to members of the 10 air groups, the respondents were less influenced by Rank in nominating Low pilots than in nominating pilots for High. The tenability of this implication, and its generality with reference to the complete sample is not unequivocal, however. As noted previously, analysis indicated that the incidence of Low nominees among members of these air groups, in relation to High nominees, was lower than for the complete sample. Furthermore, there is evidence that respondents tended to nominate for Low relatively more "outsiders" than for High; this fact explaining, perhaps, the lesser incidence of Low nominees in the 10 air groups studied than in the complete sample. This same fact might well explain why for the 10 air groups the percentage of pilots of any given rank, nominated for Low, was relatively constant from Ensign up through Commander. That is, a number of the "outsiders" nominated for Low, who did not appear on the roster of the air groups, might also have been predominately pilots of lower rank.[8]

Considering only High and Low nominees, the trend in the subsample is similar to that observed for the total sample of 4325 nominees, except for a somewhat lower incidence of nominations for Low. In other words the 147 senior officers nominated High comprised 42 per cent of the High nominees as compared with the 48 Senior officers nominated Low, representing 24 per cent of the Low nominees.

<u>Distributions by Age, and Date of Completion of Primary Training.</u> Distributions of pilots nominated for High and for Low, and receiving Mixed

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[8] With regard to this explanation both of the lower incidence of Low nominations, and of the consistency from rank to rank of the proportion of pilots nominated Low, in the 10 air groups, one important question might be raised. Why, it might be asked, did not a sufficiently large number of pilots in these air groups receive nominations from respondents in other air groups to whom they were "outsiders" to make untenable the explanation in question? An answer to this question would depend on an analysis of the source of the nominations of men in the 10 air groups under study, an analysis which has not been made. It is very probable, however, that such "outsiders," nominated by men in other air groups, represented pilots whom the respondents were acquainted with some time in the past, and who, because of greater attrition among Low nominees for any number of reasons, did not appear on the rosters of the air groups at the time the study was made.

TABLE 4.8

SUMMARY OF NOMINATED AND NON-NOMINATED PILOTS IN 10 AIR GROUPS BY RANK. ANALYSIS INCLUDES ALL MEN APPEARING IN EITHER OR BOTH OF TWO ROSTERS SPACED SIX MONTHS APART

	HIGH		LOW		MIXED		NOT NOMINATED		TOTAL	No. Highs / No. Lows
	N	%	N	%	N	%	N	%	N	
Comdrs. and Lt. Comdrs.	23	56.1	6	14.6	9	22.0	3	7.3	41	3.83
Lieutenants	124	46.4	42	15.7	41	15.4	60	22.5	267	2.95
Lieutenant (jg)	128	29.7	59	13.7	14	3.2	230	53.4	431	2.17
Ensign	78	13.6	97	17.0	9	1.6	388	67.8	572	.80
Total	353	26.9	204	15.6	73	5.6	681	51.9	1311	1.73

nominations, in terms of age (year of birth) are presented in Table 4.9.* Inspection of this table indicates no marked differences in percentages of cases, between High, Low and Mixed nominees, with reference to individual year of birth categories. However, considering this table as a whole, it is evident that 28% of the High nominees were born before 1918, as compared with 22% of Low nominees, this difference in incidence being statistically significant at well below the .01 level of confidence ($X^2 = 22.6$, with one degree of freedom). This may be a reflection of the previous finding indicating a higher incidence of "senior officers" (Lieutenant senior grade and above) among pilots nominated High than among pilots nominated Low. However, it is also of interest that 33% of the pilots in the Mixed group were born before 1918. The greater incidence of older pilots among the Mixed group may be due to the fact that older pilots may have been in Naval Aviation longer, and thus received a greater number of nominations, thereby increasing the chance for inclusion in the "Mixed" group.

Examination of the distributions in terms of date of entrance into primary training, presented in Table 4.10,* indicates the same general trend as did the distributions in terms of age. There is a trend indicating a relationship between year of entering primary training and incidence of High (or Low) nominations. For example, 80% of the Low nominees entered primary training during 1942 or later, as compared with 70% of the High nominees,[9] whereas only 58% of the Mixed nominees entered training as late as 1942. Again this probably indicates that men who were trained later in the war did not receive as many nominations, and thus did not have an opportunity to collect as many Mixed nominations, as did men who were trained earlier. As might be expected, the number of men on whom entrance data were not available is greater for the High and Mixed nominees than for the Low nominees, since these two groups probably represented, on the whole, pilots who entered training earlier, and whose records were not as likely to have been recorded in APB files.[10]

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*Editor's note. It will be noted that the total number of cases in Tables 4.9 and 4.10 is not in agreement, and does not equal the total number of nominees obtained (4325). Apparently, in setting up these distributions, data on the complete sample were not obtained. However, the totals in these tables represent over 97 per cent of the total sample. Thus the distributions can be considered representative.

[9]This difference in incidence of High and Low nominations for groups of pilots entering primary training before 1942, and during 1942 or later, is significant at below the .01 level, X^2, with one degree of freedom, being 46.30.

[10]Analysis of data from the 10 air groups studied intensively yielded generally similar conclusions regarding age and time of entering primary training. As with the case of the analysis in terms of rank, the proportion of pilots on the roster nominated for Low tended to be relatively constant irrespective of Age or Date of completing primary training. This constancy might be explained, however, on the same grounds as the constancy in reference to Rank.

TABLE 4.9

AGE DISTRIBUTIONS OF COMBAT NOMINEES

Birthdate	High		Low		Mixed		Totals	
	F	%	F	%	F	%	F	%
1912 or Earlier	108	4.9	53	3.0	11	5.0	172	4.1
1913	47	2.1	14	.8	4	1.8	65	1.5
1914	58	2.6	36	2.0	4	1.8	98	2.3
1915	95	4.3	64	3.6	8	3.6	167	4.0
1916	135	6.1	91	5.1	23	10.5	249	5.9
1917	182	8.2	124	7.0	22	10.0	328	7.8
1918	243	10.9	157	8.9	26	11.8	426	10.1
1919	225	10.1	146	8.2	29	13.2	400	9.5
1920	307	13.8	220	12.4	36	16.4	563	13.3
1921	318	14.3	275	15.5	21	9.5	614	14.6
1922	244	11.0	274	15.5	19	8.6	537	12.7
1923	170	7.6	191	10.8	13	5.9	374	8.9
1924	91	4.1	126	7.1	4	1.8	221	5.2
	2223	100.0	1771	99.9	220	99.9	4214	99.9

TABLE 4.10

PRIMARY TRAINING ENTRANCE FIGURES FOR COMBAT NOMINEES

Primary Entry			High F	High %	Low F	Low %	Mixed F	Mixed %	Totals F	Totals %
2nd	Quarter	1944	1	0.0	1	0.0	0	0.0	2	0.0
1st	"	1944	9	.4	4	.2	1	.5	14	.3
4th	"	1943	76	3.4	94	5.3	5	2.3	175	4.2
3rd	"	1943	230	10.3	240	13.5	14	6.4	484	11.5
2nd	"	1943	246	11.1	302	17.0	14	6.4	562	13.3
1st	"	1943	170	7.6	201	11.3	20	9.1	391	9.3
4th	"	1942	162	7.3	163	9.2	17	7.7	342	8.1
3rd	"	1942	82	3.7	74	4.2	6	2.7	162	3.8
2nd	"	1942	76	3.4	58	3.3	5	2.3	139	3.3
1st	"	1942	204	9.2	97	5.5	20	9.1	321	7.6
4th	"	1941	68	3.1	55	3.1	10	4.5	133	3.2
3rd	"	1941	156	7.0	92	5.2	24	10.9	272	6.5
2nd	"	1941	175	7.9	90	5.0	23	10.5	288	6.8
1st	"	1941	81	3.6	44	2.5	10	4.6	135	3.2
4th	"	1940	15	.7	7	.4	3	1.4	25	.6
3rd	"	1940	6	.3	6	.3	1	.5	13	.3
2nd	"	1940	3	.1	0	0.0	0	0.0	3	0.0
1st	"	1940	6	.3	2	.1	1	.5	9	.2
Prior to		1940	28	1.3	6	.3	2	1.0	36	.9
No Entrance Date			430	19.3	236	13.3	44	20.0	710	16.8
			2224	99.7	1772	99.7	220	100.4	4216	99.9

<u>Nomination in Relation to Time in Squadron</u>. An analysis of the relative number of Regulars and Floaters on the roster of selected air groups who were nominated High and Low is of interest. The results of this analysis are presented graphically in Figure 4a. For the purposes of this analysis "regulars" were defined as officers who had remained with the squadron throughout the tour of duty in question; "floaters" being designated as those pilots who left the squadron before completion of the tour of duty, or who joined the squadron some time during the tour of duty, i.e., after the squadron had been formed. Inspection of this figure indicates that of the 546 normally on board at any one time, 284 were regulars. The remainder of the complement during this tour of duty was from a group of 607 pilots who were "floaters." Thirty-nine of the regulars, and 100 of the floaters were nominated, about the same proportion of nominees (14 and 16 per cent, respectively) being taken from each group. However, 64 per cent of the regulars were nominated for High, in comparison with 24 per cent of the floaters. The proportion of Mixed nominees was similarly slightly higher among the floaters.

<u>Representativeness of the Sample</u>. In closing the section of the report covering the nominees, it is desirable to consider the representative nature of the sample of pilots obtained and of the extent to which the total population of combat pilots was covered. Data on this subject are available from two sources: the intensive study of ten air groups; and less definitively, from the complete sample.

As will be recalled, in the study of the ten air groups, for any given air group names of pilots on two rosters were available; one roster of pilots being as of the time data were collected by the field investigators, the other roster being dated six months previous to this time.[11] The number and percentages of pilots nominated High, Low and Mixed, and not nominated, are presented in Table 4.11. It will be noted that approximately 50 per cent of the pilots on the roster at the time data were collected (i.e., on the "second" roster) <u>were not nominated</u>; and that approximately 52 per cent of the pilots on either or both rosters <u>were not nominated</u>. A breakdown of these data by Air Group, and an indication of the ratio of Highs to Lows, is presented in Table 4.12.

It will also be noted from this table that the ratio of Highs to Lows is somewhat higher than for the complete sample; the ratio for all cases in the ten air groups being 1.72, and for the total sample 1.24. Comparison between the ten air groups subsample, and the complete sample, in terms of the percentage of pilots nominated for High and for Low, respectively, and the percentage of mixed cases, is presented in Table 4.13. As was indicated by the ratio of Highs to Lows, it will be noted from this table that in terms of all nominated cases, the percentage of Low nominees is markedly lower in the ten air groups than for the complete sample, and the percentage of Mixed and High cases somewhat greater. Possible explanations of this fact have been discussed previously.

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[11] Two rosters separated by a six month period were employed in order to approach the total population in the air group available to the respondents as potential nominees.

TABLE A.11

NUMBERS AND PERCENTAGES OF PILOTS NOMINATED (HIGH, LOW AND MIXED GROUPS) AND NOT NOMINATED WITH VARIOUS DEFINITIONS OF THE BASE POPULATION WITH RESPECT TO STATUS OF CASE IN TWO ROSTERS SIX MONTHS APART

	HIGH		LOW		MIXED		NOT NOMINATED		TOTAL
	N	%	N	%	N	%	N	%	N
All Cases (either or both Rosters)	353	26.9	204	15.6	73	5.6	681	51.9	1311
All on First Roster	282	27.4	163	15.8	66	6.4	518	50.3	1029
On First Roster Only	26	12.0	46	21.2	9	4.1	136	62.7	217
Both Rosters	256	31.5	117	14.4	57	7.0	382	47.0	812
All on Second Roster	327	29.9	158	14.4	64	5.8	545	49.8	1094
On Second Roster Only	71	25.2	41	14.5	7	2.5	163	57.8	282

TABLE A.12

SUMMARY OF NOMINATED AND NON-NOMINATED CASES BY AIR GROUP. FREQUENCIES BASED ON A STUDY OF ALL MEN APPEARING ON EITHER OR BOTH OF TWO ROSTERS SPACED SIX MONTHS APART

Air Group	HIGH	LOW	MIXED	NOT NOMINATED	TOTAL	% NOT NOMINATED	No. HIGHS / No. LOWS
6	36	29	14	108	187	57.7	1.24
9	35	23	3	115	176	65.3	1.52
10	61	32	8	102	203	50.2	1.91
17	56	38	12	66	172	38.4	1.47
25	14	9	4	26	53	49.0	1.56
30	18	4	3	21	46	45.6	4.50
46	15	8	4	34	61	55.7	1.87
47	16	8	3	35	62	56.4	2.00
82	37	28	7	79	151	52.3	1.32
83	65	25	15	95	200	47.5	2.60
Total	353	204	73	681	1311	51.9	1.73

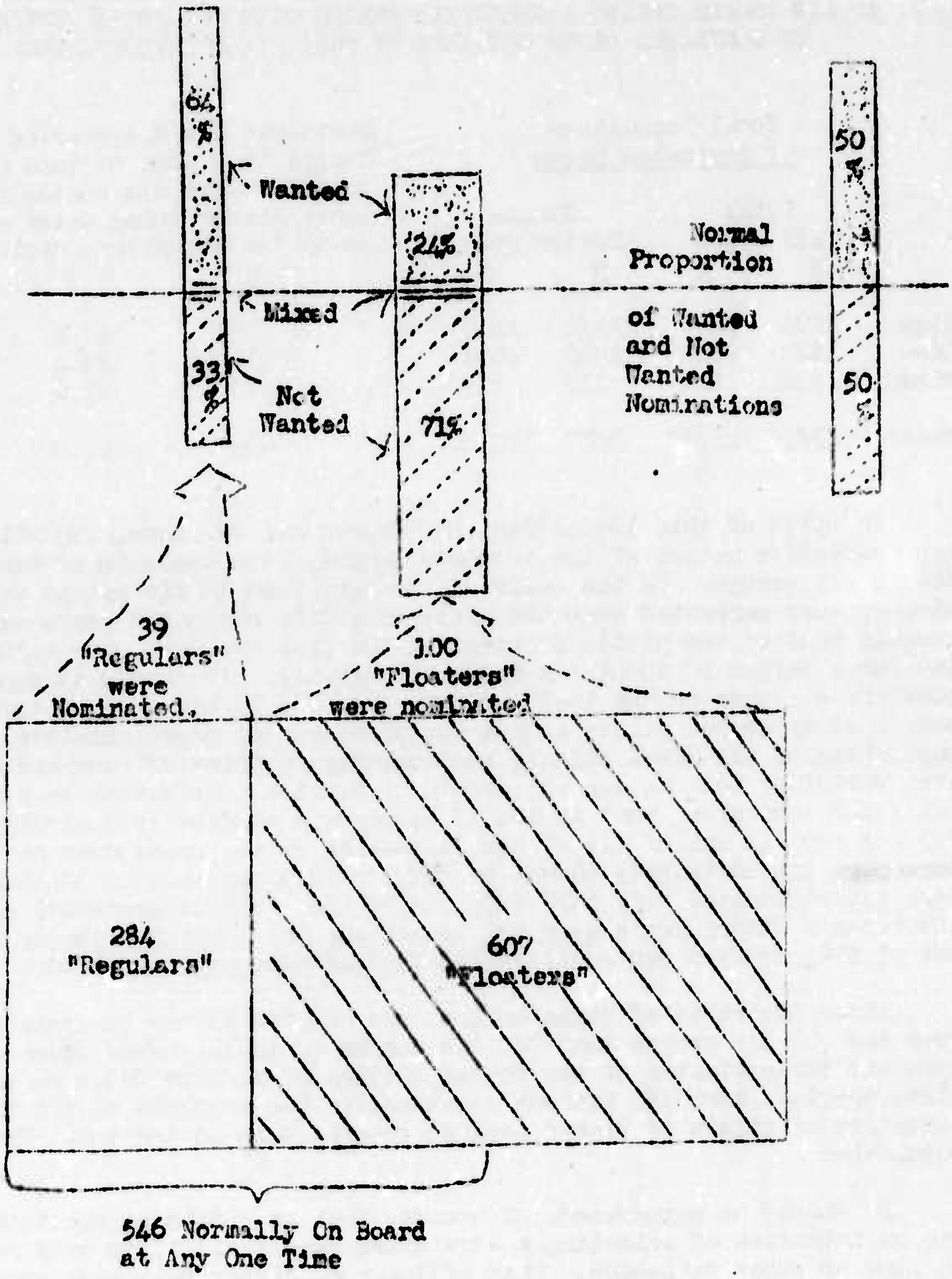

Figure 4a

RELATIVE PROPORTIONS OF "REGULARS", "FLOATERS" AND AVERAGE "ON BOARDS" IN THE TOTAL ROSTER COUNT, WITH AN INDICATION OF RELATIVE QUALITY OF THE PILOTS INVOLVED

TABLE 4.13

COMPARISON OF SAMPLE CONSISTING OF NOMINATED PILOTS APPEARING IN 10 AIR GROUPS DURING A SPECIFIED PERIOD WITH THE TOTAL POPULATION OF NOMINATED CASES OBTAINED BY FOUR FIELD INVESTIGATORS

	Total Population of Nominated Cases				Nominated Cases appearing in 10 Air Groups in either or both of two rosters taken six months apart, the later roster being dated as of the field investigator's visit	
	Total All Types		Single Engine Only			
	N	%	N	%	N	%
High	2274	52.6	1354	54.0	353	56.0
Low	1829	42.3	1006	40.1	204	32.4
Mixed	222	5.1	147	5.9	73	11.6
Total	4325	100.00	2507	100.00	630	100.00

In spite of this limitation, inferences can be drawn, regarding the representative nature of the complete sample, from analysis of data from the 10 air groups. On the basis of the data from 10 air groups the conclusion appears warranted that the group of pilots nominated represented roughly half of the pilots on board at the time the data were collected, and for a period of about six months previously. It should be emphasized, however, at least on the basis of data from the 10 air groups, that the sample of nominated pilots almost certainly is not representative of the population of all Naval pilots, particularly in terms of rank and associated variables such as age and length of service. Reference back to Table 4.8 indicates, that in the 10 air groups studied intensively, only 7.3 per cent (3 out of 41) of the Commanders or Lt. Commanders on the rosters <u>were not</u> nominated; 60 out of 267, or 22.5 per cent of the Lieutenants <u>were not</u> nominated; over half (230 out of 431, or 53.4 per cent) of the Lieutenants junior grade <u>were not</u> nominated; and about two thirds (388 out of 572, or 67.8 per cent) of the Ensigns <u>were not</u> nominated.

Since the ratio of Highs to Lows was greater in the analysis of data from the 10 air groups than for the complete sample, these figures may be somewhat low estimates of the representation of various ranks in the complete sample. However, without question, in the complete sample the representation of pilots of higher rank is greater than in the total Naval pilot population.

It should be emphasized, of course, that in obtaining nominations there was no intention of selecting a stratified sample of pilots with reference to rank or other variables. That officers of higher rank have greater representation, proportionately, among the nominees is due, in large part, to the fact that pilots of lower rank, e.g., Ensigns, had in most cases little exposure to combat, and thus were not in a position to be nominated. Also of importance, of course, is the fact that pilots of higher rank had in general been longer in the combat area, and as a result there was more opportunity for their performance, under combat conditions, to be observed.

Additional information on the representatives of the sample is afforded by two analyses of data indicating the percentage of the potential nominees who actually were nominated. On one group of 1452 cases, known to have been in combat squadrons by March 1945, and who might have been nominated, the following breakdown was obtained.

Specialty	Number	Actually Nominated	%
Carrier	642	40	6.2
VOVS	35	0	0
Patrol	350	47	13.4
Not Classified	425	15	3.8
TOTAL	1452	102	7.0

These subsamples of Carrier, VOVS, Patrol, and unclassified pilots were from a sample of 2027 cases designated as Naval Aviators from November 1942 through February 1943. That is, these officers were either in the combat area at this time, or had been some time previously. (Some of these men had been casualties, or had left the squadron for other reasons after service in the combat area.)

On another group of 2099 the following breakdown was obtained.

Specialty	Number	Actually Nominated	%
Carrier	831	69	8.3
VOVS	194	1	.5
Patrol	526	53	10.1
Not Classified	548	20	3.6
TOTAL	2099	143	6.8

(These men were from a sample of 2772 Aviation Cadets who entered preflight training in March, 1943, and were known to have been in the combat area by <u>or before</u> March, 1945.)

These men were also in combat squadrons, but may not necessarily have been in the combat areas.

Although the percentages indicated represent a reasonably adequate sample of Carrier and Patrol pilots, they again undoubtedly represent underestimates of the proportion of the actually available population of nominees who were nominated. If, on the basis of these samples, it were assumed that the total sample represented about 7 per cent of the population of combat pilots, the fact that 4325 nominees were obtained would indicate that there were over 60,000 active combat pilots in action prior to the time data were

collected. This appears a somewhat high estimate. It is probable that the March and April, 1945, samples contained a disproportionately large number of Ensigns and others (e.g., former instructors, NATS pilots, etc.) who at this point had little combat experience. Thus the sample of potential nominees, i.e., officers with sufficient combat experience to make their nomination possible, was actually less than the indicated total number of officers (1452 and 2099, respectively) in the two samples. As a conservative estimate, then, it can be said that the group of nominees represented at least about 7 per cent of the total population of combat pilots eligible for nomination, and probably represented a considerably greater percentage. There is some indication that a "planned maintenance of 5000 pilots" in the carrier pipeline only was provided for. However, even data on the total number of pilots in the combat area at the time the criterion data were collected would not prove too helpful. Actually, in determining the size of the total universe, information should be obtained on the total number of Naval Aviators actually in combat prior to the spring of 1945. This figure is difficult to determine exactly. Nevertheless, the estimate of the proportion of the total population represented by the sample does not appear too high.

Reliability of the Nominations

It is difficult to estimate the reliability of the nominations on the basis of the raw nomination data. That the reliability of the nominations is relatively high, however, is suggested by the low proportion of "Mixed" cases, i.e., pilots who were nominated for both High and Low. It will be recalled through reference to Tables 4.3 and 4.4 that of the total of 4325 pilots nominated, only 222 received nominations for both High and Low by different respondents. These 222 Mixed nominees represent 5.1 per cent of all pilots nominated, or only 12.9 per cent of all pilots nominated more than once. This relatively low proportion of Mixed nominees, even when only pilots nominated more than once are considered, indicates considerable reliability for the procedure.

Other presumptive evidence as to the reliability of the nominations is indicated by the fact, as evident in Table 4.3, that the concentration of nominations on certain individuals is intense, a number of pilots receiving nominations by over 20 respondents. One pilot was nominated for High by 3? respondents. Ten per cent of the "unmixed" pilots received 10 or more nominations, 37 per cent two or more. Furthermore Mixed cases who received many nominations were usually nominated for one or the other group by the bulk of the respondents, with only one or two dissenters.

A more rigorous estimation of the reliability of the criterion was afforded by analysis of data from one air group (Air Group 10). In this analysis an attempt was made to produce a coefficient indicating the reliability of the nominations of pilots in this air group, by splitting the respondents in the air group into two random halves, and comparing the nominations made by the two sets of respondents. The base N was the total number of men on the roster at the time of the field investigators' tour. A contingency table was set up in terms of whether pilots in the air group

were nominated by each set of respondents for High, Low, received mixed nominations, or were not nominated. The contingency table as set up for this air group, was as follows:

Respondent Set 1

		Low	Non-Nom.	Mixed	High	Total
Respondent Set 2	High	0	23	0	19	42
	Mixed	0	1	0	1	2
	Non-Nom.	9	80	0	12	101
	Low	8	7	0	0	15
	Total	17	111	0	32	160

When the very few Mixed cases (who in this group happened to receive a preponderance of High nominations) are combined with Highs the raw uncorrected contingency coefficient for this table is .506. The contingency coefficient corrected for class index, assuming normality of distribution, is .666. Thus the reliability for the sum of the two groups of respondents, in terms of the Spearman-Brown prophecy formula, can be estimated as .800.

Very similar results are obtained when nomination scores[12] obtained from the two groups of respondents are correlated. This raw correlation was .686, the estimation of the correlation based on the total number of respondents, in terms of the Spearman-Brown formula, being .814.[13]

Complete credence should probably not be placed on these figures as absolute indices, due to a number of limitations. For example, the assumption of normality of the distribution necessary for use of a corrected

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[12] A "nomination score" was computed by subtracting the number of Low nominations a man received from the number of High nominations received. For example, an officer receiving 12 High nominations and 2 Low nominations obtained a score of 10, the same score obtained by an officer receiving 10 nominations for High and none for Low. A man obtaining 7 nominations for Low and 1 for High would be assigned a score of -6. A more refined procedure for obtaining "nomination scores" will be discussed in Chapter VI.

[13] The Spearman-Brown prophecy formula is used here on the assumption that the use of a certain group of respondents in effect constitutes a <u>test</u> yielding scores for each potential nominee, these scores being expressed in broad categories as placements in the <u>High</u> group, the <u>Low</u> group, and the <u>Not-nominated</u> group; these scores however, may be regarded as having certain inherent errors as compared with the <u>true</u> placement of the individual. The Spearman-Brown formula is applicable wherever two conditions can be met; (a) the measurements are homogeneous, and (b) the use of additional measurements (groups of respondents, in this case) is expected to reduce the error variance around the true score. It seems reasonable to believe that these conditions are satisfied in the present data, within the limitations noted in the text, above.

contingency coefficient might not be completely justified. Furthermore, as will be discussed later in the report, the nomination score has certain shortcomings. Moreover, although the reliability of nominations undoubtedly is increased with an increase in the number of judges, certain minor objections might be raised to the predictions of this increase in terms of the Spearman-Brown function. However, these figures represent adequate rough estimates of the reliability of the nominations, and as such suggest an acceptable degree of reliability for the criterion.[14]

In this connection it should be emphasized that these reliability coefficients refer to the reliability with which a criterion measurement is secured on any given pilot in an air group when a sizable number of respondents is asked to nominate two Highs and two Lows either in or outside the air group. The analysis presented here is based on nominations made by 120 respondents, constituting 75% of the roster of the air group at the time of the investigators' tour. The reliability of nomination undoubtedly would be affected by the number of respondents relative to the total number on the roster, and by the number of nominations required of each respondent. However, these reliability figures probably represent <u>underestimates</u> of the reliability of <u>placement</u> of a nominated pilot in either the High or the Low group, since they involve a large number of non-nominated pilots. Of the 32 pilots nominated for High by one set of respondents (Set 1), none was nominated for Low exclusively by the other set of respondents, although 1 pilot received mixed nominations, and 12 were not nominated. In general, none of the pilots nominated exclusively for High by one set of respondents was nominated exclusively for Low by the other set of respondents.

Summary of Analysis of Nomination Data

The analyses of nomination data discussed in this chapter may be summarized as follows:

1. The group of men interviewed by the field investigators represented a relatively complete sample of the eligible respondents in the air groups visited.

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[14] It could be pointed out that the estimated reliability of the nominations might have been lower had different respondents, who nominated given nominees, come from different air groups. That is, agreement among respondents may have been influenced by the reputations of certain nominees, achieved in the single air group. To the degree that nominations were influenced by such stereotypes it would be possible that members of other air groups, had they observed the pilot under different conditions and in different situations, might not tend so markedly to agree with the nomination status ascribed to the pilot by members of Air Group 10. That is, the agreement among respondents from different air groups might be influenced by the fact that a given stereotype might not carry over from one air group to another. Strictly speaking, then, these estimates of reliability pertain to nominations made by respondents within a given air group.

2. The 4325 nominees represented approximately 50 per cent of the pilots on the air group rosters at the time data were collected, the incidence of "outsiders" among Low nominees being markedly greater than among High.

3. About 54 per cent, or 2274, of the men were nominated for High, 45 per cent, or 1829 men, being nominated for Low. There were 222 Mixed cases, representing about 5 per cent of the total number of nominees, and about 13 per cent of the nominees who were nominated two or more times.

4. About 40 per cent (1727) of the nominees received two or more nominations. Senior officers nominated High received more multiple nominations than did Junior officers nominated High. There was no significant difference in number of multiple nominations among Junior and Senior officers nominated for Low.

5. There was little difference in incidence of High and Low nominations in terms of breakdowns by Regular and Reserve Status, and in terms of specialty classification. There was, however, a difference in incidence of High and Low nominations in terms of Rank. Senior officers received a disproportionately larger number of High nominations, Junior officers receiving a disproportionately larger number of Low nominations. An analysis of data from a subsample consisting of 10 air groups indicated, however, that while the proportion of all pilots on the roster nominated for High was greater among Senior than among Junior officers, the proportion of all pilots on board nominated for Low was relatively constant from rank to rank. The generality of this implication to the total sample is not altogether unequivocal, however.

6. Analysis indicated that the incidence of High nominations among squadron "regulars" was markedly greater than among "floaters."

7. The reliability of the nominations is estimated to be in the neighborhood of .80. The general adequacy of the reliability of the nominations is suggested by the relatively few "Mixed" nominations which were obtained, and by other considerations.

CHAPTER V

ANALYSIS OF REASONS FOR NOMINATION

A discussion of analyses of "Reasons for nomination," based on categorization of free response data, has been presented in Chapter II. It will be recalled that the most frequently used categories employed for describing the Highs were not necessarily also frequently used (in a converse sense) in describing the Lows. On the basis of these studies, and growing out of the use of the "stimulator cards," checklists were developed for the collection of data in Phase II of the large scale program, as described in Chapter III. Separate checklists were developed for use by respondents in indicating reasons for giving nominations for High and for Low, respectively. Checklist A, for High, consisted of 22 items; Checklist B, for Low, consisted of 26 items. The development of these checklists has been discussed in Chapter III, and they have been presented in Appendix 3-E,b. In this chapter, analyses of data relating to reasons for nomination, as collected in Phase II of the major investigation, will be given primary emphasis.

FREQUENCY OF USE OF STIMULATOR CATEGORIES

Stimulator Categories most Frequently Used. Although in the final procedures developed for collection of data the stimulator cards were not used, it is nevertheless of interest to consider the frequency with which reasons for nomination, represented by statements on the stimulator cards, were used in reference to High and Low nominees during work preliminary to the Phase II collection of data. Such information is available from a sample of 136 Low cases and 108 High cases, and is presented in Table 5.1. It is evident, first of all, that more statements were used in describing High than Low nominees, 9.6 categories being used, on the average, per High nominee as compared with 6.7 per Low nominee.

Furthermore, the frequency of use of categories was not the same in the description of High and Low nominees, respectively. The three categories most frequently used in describing High nominees were numbers 208, 204, and 212.[1] (These categories are "gets along well with other members of squadron"; "an above average flier"; and "calm and steady in tight spots.") The three categories most frequently used for Low were 200, 210, and 205. (Reference to Appendix 3-A indicates that these are "erratic, unpredictable and unreliable"; "not a good leader of men"; and "air discipline often poor.")

Stimulator Categories least Frequently Used. The stimulator card categories least often used in connection with nomination for High were 213, 205, 209, and 211. (These categories are "combat tactics usually sound"; "above average in regard to air discipline"; "is alert" and "navigation, instrument flying bombing and gunnery very good.") The stimulator categories used least often for Low were 203, 213, and 212. ("Avoids or evades air combat"; "combat tactics often poor" and "likely to blow up.")

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[1]Stimulator card categories are presented in Appendix 3-A.

TABLE 5.1

FREQUENCY OF USE OF STIMULATORS

Category No.	Description**	138 High Cases: Rank Order	No. Cases High Cat.*	No. Cases Low Cat.	No. Cases Both Cat.	Per Cent	136 Low Cases: Rank Order	No. Cases High Cat.	No. Cases Low Cat.	No. Cases Both Cat.	Per Cent
200	Erratic, unpredictable, unreliable	5	101	-	1	73.2	1	89	2	-	65.4
201	An individualist, not a teamworker	7	97	3	1	70.3	9	64	5	1	47.1
202	Nervous and excitable	4	104	-	1	75.4	10.5	63	12	3	46.3
203	Avoids air combat	8	96	-	-	69.6	14	28	16	2	20.6
204	Can't fly well enough	2	106	-	-	76.8	8	67	11	1	49.3
205	Air discipline poor	13	83	2	1	60.1	3	77	7	-	56.6
206	Poor at sizing up situations	10	89	1	-	64.5	7	68	2	1	50.0
207	Doesn't think clearly, or plan ahead	6	98	1	-	71.0	5	71	3	2	52.2
208	Doesn't get along with mates	1	109	1	-	79.0	10.5	63	30	1	46.3
209	Dopes off	11.5	85	1	1	61.6	4	75	5	1	55.1
210	Not a good leader	9	92	1	-	66.7	2	79	8	1	58.1
211	Poor at navigation, gunnery, etc.	11.5	85	3	-	61.6	6	69	8	1	50.7
212	Likely to blow up	3	105	1	-	76.1	12	58	1	1	42.6
213	Combat-tactics poor	14	81	-	-	58.7	13	40	5	-	29.4
	Total		1331	14	5			911	115	15	

*All High categories were used on 29 High cases.

Average = 9.6 High categories per nominee.
Average = 0.1 Low categories per nominee.

Average per cent use of High categories = 68.9

Average = 6.7 Low categories per Low nominee.
Average = 0.8 High categories per Low nominee.

Average per cent use of Low categories on Low nominees = 47.8.

**A summary of the statement on only the stimulator card for Low nominees is presented. The statement on the corresponding cards used for High nominees was in general the opposite.

General Considerations. The broad pictures of good and poor combat pilots, drawn in terms of these categories, are in general agreement with the analysis of checklist reasons for nomination to be discussed later in this chapter. It is of some interest that Item 205, dealing with air discipline, is among the most frequently used categories in describing Low nominees, but among the most infrequently used categories in describing High nominees. Category 212, dealing with emotional control in tight spots is used frequently in describing High nominees, but infrequently with reference to Low nominees. Category 213, dealing with combat tactics, is infrequently used in describing both High and Low nominees. It should not be inferred that frequency of use necessarily is a measure of the importance of the category, however. The relationship between frequency and importance was discussed in Chapter II, and will be dealt with again later in the present chapter, in connection with the analysis of Phase II data.

FREQUENCY OF USE OF CHECKLIST ITEMS

In the collection of data during Phase II of the large scale investigation in the Pacific Ocean Area, checklists, as noted previously, were used in the indication of reasons for nomination, Checklist A being used in the indication of reasons for High nominations; Checklist B being used for Low nominations. The first 22 statements of Checklist B represented the converse of each of the corresponding statements on Checklist A. However, four additional items were employed in the description of reasons for Low nominations on Checklist B which had no converse counterparts on Checklist A.

As reference to Appendix 3-E, b will indicate, Checklist A consisted of 22 items, Checklist B of 26 items. The forms used by the respondents in recording their nominations and reasons for nomination have been presented in Appendix 3-E,c. It will be recalled that in recording their nominations on the forms the respondents were instructed to draw a circle around the item numbers which represented their reasons for nominating the man in question. They were then instructed to go back and indicate, by an X, the item numbers of the three reasons which in their opinion represented the major considerations in making the nomination.

In transferring the nominations and reasons for nomination to data cards, however, the numbers of the applicable reasons were entered on these cards, and the numbers of the three major reasons were circled. Therefore, in the remainder of this report, the term "Circled reasons" will denote use of certain items as one of the three major considerations which, in the opinion of the respondent, represented the basis for his nomination. It is recognized that this terminology may lead to some confusion. Since, however, the term "Circled reasons" was used, in the data and reports of the Aviation Psychology Branch, to designate major reasons for nomination, this terminology will be followed in this report.

The frequency with which each of the checklist items was indicated as one of the three most outstanding reasons for nomination are presented in Table 5.2, broken down in terms of Single engine, Multi-engine, and unclassified pilots, in terms of "Junior" and "Senior" officers, respectively, and

TABLE 5.2

FREQUENCY OF USE OF CIRCLED CATEGORIES BY GROSS RANK AND SPECIALTY CLASSIFICATIONS
4103 HIGH OR LOW CHECK LIST NOMINEES

Includes all of original population of 4325 nominees after 222 "MIXED" cases excluded 9-25-45

Categories from either A or B List	Single Engine Pilots								Multi-Engine Pilots								Unclassified				Total			
	Junior Officers				Sr. Officers				Jr. Officers				Sr. Officers											
	Highs		Lows		Highs		Lows		Highs		Lows		Highs		Lows		Highs		Lows		Highs		Lows	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	210	29	135	18	347	54	62	23	89	34	20	10	135	46	43	23	93	26	59	14	874	38.4	319	17.4
2	145	20	137	19	168	26	30	11	75	29	49	24	92	31	15	8	63	17	51	12	543	23.9	282	15.4
3	109	15	102	14	133	21	44	17	49	19	34	17	73	25	44	24	48	13	64	15	412	18.1	288	15.7
4	251	35	308	42	287	45	112	42	79	30	44	21	103	35	58	32	95	26	114	26	815	35.8	636	34.8
5	133	19	138	19	198	31	54	20	35	13	37	18	67	23	17	9	93	15	60	14	486	21.4	306	16.7
6	72	10	113	15	75	12	38	14	22	8	25	12	26	9	14	6	23	6	41	9	218	9.6	231	12.6
7	173	24	76	10	198	31	51	19	22	8	19	9	60	20	34	19	40	11	26	6	493	21.7	206	11.3
8	90	13	72	10	167	26	40	15	53	20	25	12	75	25	17	9	45	12	24	6	430	18.9	178	9.7
9	317	44	109	16	261	41	44	17	78	30	20	10	87	29	27	15	100	28	55	13	843	37.1	255	13.9
10	70	10	192	26	98	15	85	32	22	8	67	33	37	12	60	33	24	7	113	26	251	11.0	517	28.3
11	121	17	44	6	140	22	14	5	61	23	14	7	72	24	10	5	60	17	9	2	454	20.0	91	5.0
12	50	7	55	7	127	20	36	14	8	3	8	4	32	11	16	9	18	5	18	4	235	10.3	133	7.3
13	113	16	88	12	154	24	22	8	47	18	16	8	96	32	31	17	54	15	32	7	464	20.4	189	10.3
14	125	18	75	10	194	30	26	10	58	22	14	7	87	29	23	13	44	12	41	9	506	22.3	179	9.8
15	75	11	47	6	123	19	9	3	62	24	27	13	127	43	19	10	61	17	23	5	440	19.7	125	6.8
16	80	11	42	6	181	28	11	4	40	15	16	8	70	24	10	5	42	12	12	3	413	18.2	91	5.0
17	56	8	173	23	204	32	105	39	18	7	59	29	68	23	69	38	71	20	92	21	417	18.3	498	27.2
18	121	17	72	10	91	14	31	12	39	15	26	13	65	22	45	25	37	10	44	10	353	15.5	218	11.9
19	113	16	98	13	76	12	32	12	21	8	23	11	31	10	30	16	40	11	47	11	281	12.4	230	12.6
20	49	7	18	2	82	13	16	6	17	6	10	5	13	4	9	5	26	7	11	3	187	8.2	64	3.5
21	47	7	83	11	83	13	31	12	42	16	32	16	43	15	18	10	21	6	36	8	236	10.4	200	10.9
22	164	23	163	22	158	25	60	23	52	20	45	23	111	37	43	23	66	18	77	18	551	24.2	388	21.2
23			145	20			46	17			24	12			15	8			40	9			270	14.8
24			98	13			36	14			24	12			13	7			46	11			217	11.9
25			112	15			27	10			29	14			34	19			66	15			268	14.7
26			42	6			19	7			8	4			16	9			20	5			105	5.7
Total Cases*	713		740		641		266		262		206		296		183		362		434		2274		1829	

*Does not equal sum of column since more than one category used on same case. Percentages, however, are based on these N's and consequently represent per cent of individuals upon whom category used.

for the total of all clear (i.e., not mixed) cases. It should be noted that, as with respect to the free response categories, more reasons for nomination were indicated for High than for Low nominees. An average of 4.38 items were checked as "circled" reasons for each High nominee, as compared with 3.55 items for Low nominees. (The average number of circled reasons per nominee is greater than 3 since many nominees were nominated by more than one respondent, and not always for the same reason.) The rank order, in terms of frequency of use, of both A and B list items as circled and uncircled entries is presented in Table 5.3.

Reason for High Nominations. Reference to these two tables indicates that the statement most often circled by respondents as being particularly outstanding as descriptive of High nominees, is Item 1, "Feels responsible for the safety of all personnel flying in combat with him." This item was circled as being particularly important in describing 38 per cent of all High nominees. Next in frequency, being circled in connection with 37 per cent of all High nominees, was Item 9, "A team worker. You can count on him and he will count on you." The least frequently circled item with reference to Highs was Item 20, used in connection with 3 per cent of the Highs: "Excellent .. in bombing, gunnery, etc." It may be of course that most pilots nominated for High were accepted as adequate in these technical aspects. However, the emphasis on reasons pertaining to teamwork in describing High nominees is of particular interest.

Reasons for Low Nominations. With reference to the circled items used in describing nominees for Low, the item most frequently used was number 4, "Erratic, unpredictable in the air...," circled with reference to 35 per cent of the nominees. Next most frequently circled in reference to Low nominees were Items 10 and 17, "Won't listen to criticism..." and "Not a leader of men...," circled with reference to 28 and 27 per cent of nominees, respectively. Least used was Item 20, "Poor in...bombing, gunnery, etc.," employed in connection with only 3 per cent of the nominees. This item, and its converse, were least frequently circled in reference to describing both High and Low nominees. This would appear to be an indication that Naval combat aviation demands much more than mere technical skill. This conclusion appears warranted even though the low frequency of use of this item could be explained, in some measure, by the fact that Naval pilots are undoubtedly highly selected in terms of this technical qualification.

Uncircled Reason. Considering "uncircled" reasons, i.e., all items indicated, the most frequently used item given as a reason for a High nomination was Item 4 "Steady and reliable in the air." This item was mentioned in connection with 85 per cent of all High nominees. Least frequently mentioned (in connection with 50 per cent of High nominees) was Item 12, "Accurately sizes up tactical situations." The most frequently used item describing Low nominees was Item 11, "Keeps to himself, doesn't mix," used in connection with 99 per cent of all Low nominees. Least frequently used item (with reference to only 20 per cent of the Low nominees) was Item 26 "Lies about his experiences and cheats on his score" -- an item which had no converse descriptive of High nominees. Thus it is evident that certain items were used as uncircled reasons for nomination in connection with nearly all nominations, and that each of the A list reasons for nomination were applied to at least half of the group of High nominees. This is in line with other evidence indicating the High nomi-

TABLE 5.3

RANK ORDER IN TERMS OF FREQUENCY OF USE OF CIRCLED, AND BOTH CIRCLED AND UNCIRCLED ITEMS

Item No.	Categories (A List)	HIGH: Circled & Un-circled	HIGH: Circled Only	LOW: Circled & Un-circled	LOW: Circled Only	Item No.	Categories (B List)
1.	He feels responsible for the safety of all personnel flying in combat with him.	5	1	18	5	1.	Too worried about his own safety. Would save his own neck even at the expense of his squadron mates.
2.	Takes his job seriously.	4	5	12	4	2.	Hasn't grown up. Doesn't take his work seriously.
3.	Even-tempered and well-balanced on the ground.	6	15	11	7	3.	Temperamental, irritable, or quick tempered on the ground.
4.	Steady and reliable in the air.	1	3	2	1	4.	Erratic, unpredictable in the air. You can never tell what he will do next.
5.	Alert. Knows what's going on every minute in the air.	13	8	6	6	5.	Dopes off. Flies with his head "in the cockpit."
6.	Gets the word quickly and remembers well.	15	21	7	13	6.	Just doesn't get the word. Learns slowly and forgets fast.
7.	Is aggressive. Presses home the attack.	18	7	25	16	7.	Avoids or evades going on combat missions.
8.	Thinks fast enough to reach wise decisions quickly.	9	12	10	20	8.	Can't make up his mind quickly. Doesn't think fast enough to keep up with his airplane.
9.	A team-worker. You can count on him and he will count on you.	2	2	13	11	9.	No sense of teamwork. Would leave you in the lurch in order to make a name for himself.

TABLE 5.3 (Continued)

Item No.	Categories (A List)	HIGH Circled & Uncircled	HIGH Circled Only	LOW Circled & Uncircled	LOW Circled Only	Item No.	Categories (B List)
10.	Welcomes suggestions and reacts well to criticisms.	16	18	4	2	10.	Won't listen to criticism. Thinks his way is always right.
11.	Gets along well with squadron mates; mixes well.	3	10	1	24	11.	Keeps to himself; doesn't mix.
12.	Accurately sizes up tactical situations.	22	20	14	21	12.	Poor at sizing up tactical situations.
13.	Easy-going and not easily excited.	8	9	23	18	13.	Nervous and tense even on the ground.
14.	Does not take foolish risks which endanger the lives of others.	9	6	24	19	14.	Deliberately takes foolish risks in his airplane, unnecessarily endangering the lives of others.
15.	Knows his airplane and its equipment.	10	11	21	22	15.	Doesn't know his airplane or equipment.
16.	Always thinks ahead and figures things out. Has a plan for any situation that is likely to come up.	21	14	20	25	16.	Doesn't plan ahead but relies on luck. Acts first and thinks second.
17.	He is a real leader of men. Has the respect and confidence of others.	20	13	3	3	17.	Not a leader of men. Doesn't have the confidence and respect of others.

TABLE 5.3 (Concluded)

Item No.	Categories (A List)	HIGH Circled & Un-circled	HIGH Circled Only	LOW Circled & Un-circled	LOW Circled Only	Item No.	Categories (B List)
18.	Holds up well in tight spots.	12	16	9	14	18.	Likely to blow up when the going gets tough.
19.	Loves to fly.	19	17	19	12	19.	Lacks desire to fly.
20.	Excellent in one or more of the following: (Specify by letter). a. Bombing b. Gunnery c. Instrument flying d. Aerology e. Navigation	17	22	22	26	20.	Poor in one or more of the following: (Specify by letter). a. Bombing b. Gunnery c. Instrument flying d. Aerology e. Navigation
21.	Carries out his responsibilities promptly and properly.	14	19	17	17	21.	Irresponsible, lazy, or careless. Doesn't carry through his duties promptly and properly.
22.	Excellent plane-handler. Gets the most out of his airplane.	10.5	4	8	4	22.	Just can't fly well enough.
				5	9	23.	Always has excuses for anything done wrong.
				16	15	24.	Dilbert. Always pulling some dumb stunt.
				15	10	25.	Thinks he is a hot pilot.
				26	23	26.	Lies about his experience and cheats on his score.

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nations tended more to be made for a generality of reasons than was the case with Low nominations.

Relationship between Circled and Uncircled Items. It is noteworthy that the relationship between frequency with which given items were circled as being one of the three major reasons for nominating a man High or Low, and the frequency with which given items were marked merely as descriptive, (i.e., were not circled) is relatively high, although a number of marked differences in rank is evident. The rank order correlation coefficient between "frequency of marking" and "frequency of circling" for High nominees is .67; for Low nominees .58. The coefficients cannot be considered high, since considerable covariance was induced by the fact that all circled reasons also, by definition, were counted in determining the frequency of use of an item as an uncircled entry. An interesting example is Item 11, referring to ability to get along with squadron mates, or to "mix." For High nominees, this item ranked third among all reasons, but tenth among circled reasons. For Low nominees this item ranked first among all reasons, but twenty-second among circled reasons.

This is of some interest due to the fact that a possible criticism of the validity of the nominating technique might be that the nominations were based on respondent's general feeling toward the nominee, whether he was a "good Joe," rather than on an evaluation of his combat proficiency. These data would indicate that while "being a good mixer" or its converse ranks high in its application to both High and Low nominees in general, it does not rank high, particularly in regard to poor combat pilots, as one of the three major reasons for making specific nominations. These facts obviously do not represent a definitive answer to the criticism, but their implications are suggestive. This problem incidentally, will be discussed in greater detail later in Chapter VII, and in Chapter VIII.

Frequency of Item Use for High and Low, Respectively. It is of interest that the converse of the reasons most frequently used for nominations for High are not in general those most frequently used for nominations for Low, either with reference to circled or to uncircled checklist items. Item 4, "Steady and reliable in the air" and its converse ranked among the highest three reasons, in terms of frequency, used in connection with nominations for High or for Low, and with reference both to circled and uncircled items. With this exception, however, items used were generally different. The rank order correlation indicating the relationship between frequency of use of reasons for nominating High and Low, in terms of uncircled items, was .25. For circled items the coefficient was .38. This would suggest that the typical personal characteristics of Low nominees are not necessarily the exact antitheses of the personal characteristics of High nominees. The typical High nominee, on the basis of circled items, might be termed "a teamworker, aware of his responsibility for his fellow-pilots, and steady and reliable in the air." The typical Low nominee might be termed, accordingly, "not a man in whom his mates have confidence, one who is erratic and unpredictable in the air, and who will not listen to criticism."

Relation between Frequency of Use and Specialty Classification. In Table 5.4 are presented the rank orders in terms of frequency of use of the various circled "reason for nomination" items by specialty classification. Inspection of this table indicates general agreement between the frequency of use of items in describing Single Engine, Multi-Engine, and "Unclassified" pilots, for High or for Low, respectively. This degree of agreement is indicated by the fact that the rank order correlation between frequency of use

TABLE 5.4

FREQUENCY OF USE OF CIRCLED CATEGORIES BY SPECIALTY

	HIGH			HIGH			HIGH			LOW			LOW			LOW		
	Single Engine Pilots			Multi-Engine Pilots			Unclassified			Single Engine Pilots			Multi-Engine Pilots			Unclassified		
Item No.	No.	%	Rank	No.	%	Rank	No.	%	Rank	No.	%	Rank	No.	%	Rank	No.	%	Rank
1	557	41	2	224	40	1	93	26	3.5	197	20	5	63	16	8.5	59	14	8
2	313	23	3	167	30	4	63	17	7	167	17	8	64	16	7	52	12	10
3	242	18	14	122	22	11	48	13	11	145	15	11	78	20	5	64	15	6
4	538	40	3	182	33	3	95	26	2	420	42	1	102	26	3	114	26	1
5	331	24	5	102	18	14	93	26	3.5	192	19	6	54	14	10	60	14	7
6	147	11	20	48	09	20	23	06	20	151	15	10	39	10	18.5	41	09	14.5
7	371	27	4	82	15	17	40	11	15.5	127	13	15	53	14	11.5	26	06	19
8	257	19	13	128	23	10	45	12	12	112	11	17	42	11	17	24	06	20
9	578	43	1	165	30	5	100	28	1	153	15	9	47	12	14.5	55	13	9
10	168	12	19	59	11	18	24	07	19	277	28	3	127	33	2	113	26	2
11	261	19	10.5	133	24	9	60	17	9	58	06	23	24	06	24	9	02	26
12	177	13	18	40	07	21	18	05	22	92	09	21	24	06	24	18	04	23
13	267	20	9	143	26	8	54	15	10	110	11	18	47	12	14.5	32	07	18
14	319	24	7	145	26	7	44	12	13	101	10	20	37	10	20.5	41	09	14.5
15	198	15	16	189	34	2	61	17	8	56	06	24	46	12	16	23	05	21
16	261	19	10.5	110	20	12	42	12	14	53	05	25	26	07	22	12	03	24
17	260	19	12	86	15	15	72	20	5	278	28	2	128	33	1	92	21	3
18	212	16	15	104	19	13	37	10	17	103	10	19	72	18	6	44	10	13
19	189	14	17	52	09	19	40	11	15.5	130	13	14	53	14	11.5	47	11	11
20	131	10	21	30	05	22	26	07	18	34	03	26	19	05	26	11	03	25
21	130	10	22	85	15	16	22	06	21	114	11	16	50	13	13	36	08	17
22	322	24	6	163	29	6	66	18	6	223	22	4	88	23	4	77	18	4
23										191	19	7	39	10	18.5	40	09	16
24										134	13	13	37	10	20.5	46	11	12
25										139	14	12	63	16	8.5	66	15	5
26										61	06	22	24	06	24	20	05	22
Total Cases*	1354			558			362			1006			389			434		

*Does not equal sum of column since more than one category used on same case. Percentages, however, are based on these N's and consequently represent per cent of individuals upon whom category used.

of items for single and multi-engine nominations is in the neighborhood of .70 for both Lows and Highs, the rank order coefficients for the various breakdowns being as follows:

	SE vs. ME	SE vs. Uncl.	ME vs. Uncl.
Lows	.77	.89	.87
Highs	.68	.80	.77

Marked differences in rank of items in terms of frequency of use for nominating High, between single engine and multi-engine pilots were evident for:

Item 15: "Knows his airplane and equipment"; ranked sixteenth for single engine pilots, second for multi-engine pilots.

Item 7: "Is aggressive, presses home the attack"; ranked fourth for single engine pilots, seventeenth for multi-engine pilots.

Item 5: "Alert, knows what's going on every minute in the air"; ranked fifth for single engine pilots, fourteenth among multi-engine pilots.

These differences in frequency of use of reasons for nomination clearly reflect known differences in the equipment used, and the types of operation engaged in, by single and multi-engined pilots, respectively. This fact in itself lends considerable face validity to the items as representative of reasons for nomination. On the other hand the minor differences in relative frequency of use for other items warrant the pooling of data over specialty groups in considering the implications of the analysis of reasons for nomination.

Marked differences in frequency of use of reasons for Low nomination (as circled entries), between single and multi-engine pilots were evident for:

Item 18: "Likely to blow up when the going gets tough"; ranked nineteenth for single engine pilots, and sixth for multi-engine pilots.

Item 23: "Always has excuses for anything done wrong"; ranked seventh for single engine pilots, and tied for rank 18-19 for multi-engine pilots.

Item 6: "Just doesn't get the word. Learns slowly and forgets fast"; ranked tenth among single engine pilots, and tied for rank 18-19 for multi-engine pilots.

Item 15: "Doesn't know his airplane or equipment"; ranked twenty-fourth among single engine pilots, and sixteenth among multi-engine pilots.

Except for Item 15, the difference in relative frequency of use of these items between single and multi-engine pilots as reasons for nominations of Low is not explainable on as immediately evident grounds as was the case with reasons for nomination for High. It should be noted that the differences in relative frequency of use are not in general as great for Low as for High, and that no items were ranked among the first five for one specialty and very low for the other. It might be suggested for example that conditions conducive to "blowing up" are induced by the complexities of the multi-engine plane, as compared to a carrier aircraft, but such inferences are perhaps not completely justified by the data.[1] The fact that with few exceptions differences in relative frequency of use are not great warrants the pooling of data over several groups.

It is evident from inspection of Table 5.4 that, by specialties, counter-parts of items used most frequently in describing Highs are not necessarily most frequently used in describing Lows. This, of course, is in accord with the findings from the pooled data on reasons for nominations from the entire group, irrespective of classification.

Relation between Frequency of Use and Gross Rank. The rank orders of the various item "reasons for nomination," in terms of frequency of use by Gross rank are presented in Table 5.5. Inspection of this table indicates that there is general agreement as to frequency of use of the various items in nominating "Senior" and "Junior" officers, respectively. The rank order correlation between Senior and Junior for High is .73; for Low, .74.

Among reasons for nomination of High, the only marked difference in relative frequency of use of a reason, among Senior and Junior officers, occurs with reference to Item 17, "He is a real leader of men. Has the respect and confidence of others." This item ranked fifth as a major consideration in terms of frequency of use in the nomination of Senior officers, but twentieth for the nomination of Junior officers. This is not unreasonable, since Senior officers would be in positions demanding greater leadership, where this characteristic could be more directly observed.

Among reasons for nomination for Low, marked differences occur for Items 2 and 17; and less appreciably for Item 18:

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[1]One explanation might be that there is an "interaction" between specialty and rank. However, inspection of the percentage values for Low Items 6, 15, 18 and 23 in Table 5.2 suggests that this explanation would not be tenable, except perhaps for Item 18, although even for this item the indication could not be considered statistically significant. A few differences in relative frequency of use could, of course, be expected to arise by chance.

TABLE 5.[illegible]

RANK ORDER OF ITEMS BY GROSS RANK

Item No.	HIGH Junior Officers No.	%	Rank	HIGH Senior Officers No.	%	Rank	HIGH Difference in Rank	LOW Junior Officers No.	%	Rank	LOW Senior Officers No.	%	Rank	LOW Difference in Rank
1	299	31	3	482	51	1	2	155	16	8	105	23	4	4
2	220	23	4	260	28	8	4	186	20	5	45	10	21	16
3	158	16	12	206	22	15	3	136	14	11	88	20	6	5
4	330	34	2	390	42	2	0	352	37	1	170	38	2	1
5	168	17	9	265	28	7	2	175	18	6	71	16	9.5	3.5
6	94	10	17	101	11	21	4	138	15	10	52	12	16.5	6.5
7	195	20	6	258	28	9	3	95	10	19	85	19	7	12
8	143	15	13	242	26	13	0	97	10	18	57	13	14	4
9	395	41	1	348	37	3	2	129	14	12	71	16	9.5	2.5
10	92	09	18	135	14	18	0	259	27	2	145	32	3	1
11	182	19	8	212	23	14	6	58	06	23.5	24	05	25	1.5
12	58	06	22	159	17	16	6	63	07	22	52	12	16.5	5.5
13	160	16	10.5	250	27	11.5	1	104	11	16	53	12	15	1
14	183	19	7	281	30	4	3	89	09	20	49	11	19	1
15	137	14	14	250	27	11.5	2.5	74	08	21	28	06	23	2
16	120	12	16	251	27	10	6	58	06	23.5	21	05	26	2.5
17	74	08	20	272	29	5	15	232	25	3	174	39	1	2
18	160	15	10.5	156	17	17	6.5	98	10	17	76	17	8	9
19	134	14	15	107	11	20	5	121	13	14	62	14	11	3
20	66	07	21	95	10	22	1	28	03	26	25	06	24	2
21	89	09	19	126	13	19	0	115	12	15	49	11	19	4
22	216	22	5	269	29	6	1	208	22	4	103	23	5	1
23								169	18	7	61	14	12.5	5.5
24								122	13	13	49	11	19	6
25								141	15	9	61	14	12.5	3.5
26								50	05	25	35	08	22	3
Total Cases*	975			937				246			449			

*Does not equal sum of column since more than one category used on same case. Percentages, however, are based on these N's and consequently represent per cent of individuals upon whom category used.

Item 2: "Hasn't grown up. Doesn't take his work seriously"; was fifth in frequency of use for Junior officers, and twenty-first for Senior officers.

Item 7: "Avoids or evades going on combat missions"; was nineteenth in frequency of use among Junior officers, but seventh in frequency of use among senior officers.

Item 18: "Likely to blow up when the going gets tough"; ranked seventeenth in frequency of use for Junior officers, but eighth in terms of frequency of use for Senior officers.

These differences in incidence are not surprising, in regard to Items 2 and 18, since the characterization "hasn't grown up" could be expected to be applied more often to Junior officers; and since Senior officers might be expected to be observed in "tougher" situations where the consequences "blowing up" would be more serious.[2] However, the finding that the reason "Evades going on combat missions" was used with markedly greater frequency in describing Senior, than Junior officer nominees for Low is of particular interest. It is possible that evidence of this characteristic was considered a more serious shortcoming for Senior than for Junior officers, although such an inference cannot be considered more than speculative in the absence of additional logical or experimental support.

In general it is evident that differences in relative frequency of use of the various item reasons for nomination, in terms of gross rank, are not large. The pooling of reason for nomination data by gross rank has been warranted.

Implications of Breakdowns by Specialty and by Gross Rank. These breakdowns by specialty and by gross rank, while not marked, do suggest certain insights into differences in characteristics most frequently observed among good and poor (or "wanted" and "not wanted") combat pilots, of various ranks and classifications. It is of interest, for example, that respondents observed leadership characteristics more often among Senior officers nominated for High, than among Junior officers nominated for High, but did not make this differentiation (in terms of frequency of use) in considering Low or "not wanted" combat pilots. Moreover, it is noteworthy that differences in frequency of use were more readily explained for High than for Low reasons for nomination. These findings also have implications for further statistical treatment of the data, as by factor analysis, to be considered in chapter VII.

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[2]Again, inspection of Table 5.2 does not suggest any marked interaction between specialty and rank for these items.

JUDGED IMPORTANCE OF REASONS

One hundred and sixty four pilots (82 carrier and 82 multi-engine pilots) were asked to rank the various Checklist A items in order of importance. They were instructed first to sort the items into four piles as follows:

Pile #1: Outstanding good points. These are the characteristics of the very best leaders and the finest squadron mates.

Pile #2: Marked good points. These traits in a man make him above average as a leader and squadron mate.

Pile #3: Minor virtues: These traits in a man make him slightly better than average as a leader and squadron mate.

Pile #4: Trivial points. While some people might like these traits, it is my opinion that they make little difference in a man's status as a leader or squadron mate.

Following this they were asked to go through and put the items in each pile into rank order, from most to least important. It is significant that none of the items was considered a "trivial point" by the majority of the pilots interviewed. The same procedure was followed with reference to items in Checklist B, to determine the importance of items in nominations for low, except that the items were first sorted into the following four piles:

Pile #1: Very serious defects and drawbacks. Men described by these cards should be put on the beach for the good of the squadron.

Pile #2: Serious defects. These traits in a man make him a real liability to his combat team.

Pile #3: Minor drawbacks. A man's usefulness to a combat team is somewhat reduced by these traits.

Pile #4: Unimportant items. While some people might dislike these traits, it is my opinion that they make little difference in a man's value as a combat team.

Again, as in the case of the judged importance of High characteristics, although there were appreciable differences in the rated importance of the categories, not one category was considered so unimportant as to be placed in Pile #4 by the majority of the pilots interviewed. The implication, as for the High checklist items, is that all of the characteristics are important, although in differing degree.

Rank Order of Items in Terms of Importance. The rank order of the various traits, in terms of their judged importance, is indicated in Table 5.6. In this table the rank order of items in terms of frequency of use as circled entries also is included. The most important traits, as indicated by the pilots' judgments, are the following:

> "He feels responsible for the safety of all personnel flying in combat with him." (Item 1)
>
> "Alert. Knows what's going on every minute in the air." (Item 5)
>
> "He is a real leader of men. Has the respect and confidence of others." (Item 17)
>
> "Steady and reliable in the air." (Item 4)

The most important traits characterizing undesirable combat pilots were indicated as follows:

> "Too worried about his own safety. Would save his own neck even at the expense of his squadron mates." (Item 1)
>
> "Deliberately takes foolish risks in his airplane, unnecessarily endangering the lives of others." (Item 14)
>
> "No sense of teamwork. Would leave you in the lurch in order to make a name for himself." (Item 9)
>
> "Dopes off. Flies with his head 'in the cockpit'." (Item 5)
>
> "Erratic, unpredictable in the air. You can never tell what he will do next." (Item 4)

The three items judged least important as characteristics of good pilots were Items 13, 19 and 11 ("Easy going"; "Loves to Fly"; and "Gets along well with squadron mates."). The three items judged least important as characteristic of poor combat pilots were Items 11, 25 and 23. The converse of Item 11 "Keeps to himself, doesn't mix" was also judged as one of the least important attributes of a good combat pilot. Items 25 and 23, however, ("Thinks he is a hot pilot" and "Lies about his experience.") were among the four items on Checklist B which had no counterparts in Checklist A.

Relationship between Judged Importance of Categories for High and Low. In contrast to the situation in terms of frequency of use there is a considerable measure of agreement in the judged importance of categories for High and Low, respectively. That is, the converse of items judged important as High characteristics tended, in some measure, to be judged important as characteristics of Low, or poor combat pilots, the rank order coefficient between judged importance of characteristics and their counterparts High and Low being .74, excluding from consideration Items 23 to 26 which had no counterparts on the A list used for High nominations.

TABLE 5.6

COMPARISON OF RANK ORDER OF ITEMS IN TERMS OF JUDGED IMPO

Item No.	List A (for High Nominees)	Rank Order of Frequency Highs	Lows	Rank List
1.	Feels responsible for safety of other personnel.	1	5	1
2.	Takes his job seriously.	5	8	12
3.	Even-tempered, well balanced on the ground.	15	7	19
4.	Steady and reliable in the air.	3	1	4
5.	Alert. Knows what goes on in air	8	6	2
6.	Gets the word quickly and remembers well.	21	13	14
7.	Aggressive. Presses home the attack.	7	16	13
8.	Thinks fast. Reaches wise decisions quickly.	12	20	6
9.	A team-worker. Can be counted on.	2	11	7
10.	Welcomes suggestions. Takes criticisms well.	18	2	18
11.	Gets along well with squadron mates.	10	24	22
12.	Accurately sizes up tactical situations.	20	21	10
13.	Easy going and not easily excited.	9	18	20
14.	Does not take foolish risks.	6	19	8
15.	Knows his airplane and its equipment.	11	22	11
16.	Thinks ahead and figures things out.	14	25	5
17.	A real leader. Has confidence of others.	13	3	3
18.	Holds up well in tight spots.	16	14	9
19.	Loves to fly.	17	12	21
20.	Excellent in one or more of the following: a. Bombing; b. Gunnery; c. Instrument flying; d. Aerology; e. Navigation.	22	26	17
21.	Carries out his responsibilities promptly and properly.	19	17	16
22.	Excellent plane-handler.	4	4	15
23.		-	9	-
24.		-	15	-
25.		-	10	-
26.		-	23	-

E 5.6

D IMPORTANCE AND FREQUENCY OF USE AS CIRCLED ENTRIES

Rank Order of Importance			
List A	List B	Item No.	List B (for Low Nominees)
1	1	1.	Too worried about his own safety.
12	20	2.	Hasn't grown up. Doesn't take his work seriously.
19	23	3.	Temperamental, irritable, quick-tempered on ground.
4	5	4.	Erratic, unpredictable in the air.
2	4	5.	Dopes off. Flies with head "in the cockpit."
14	12	6.	Just doesn't get the word. Learns slowly.
13	6	7.	Avoids and evades going on combat missions.
6	9	8.	Can't make up his mind quickly.
7	3	9.	No sense of teamwork.
18	17	10.	Won't listen to criticism. Thinks he is always right.
22	26	11.	Keeps to himself; doesn't mix.
10	16	12.	Poor at sizing up tactical situations.
20	21	13.	Nervous and tense even on the ground.
8	2	14.	Deliberately takes foolish risks.
11	11	15.	Doesn't know his airplane or equipment.
5	13	16.	Doesn't plan ahead. Acts first and thinks second.
3	15	17.	Not a leader. Doesn't have confidence of others.
9	8	18.	Likely to blow up when the going gets tough.
21	19	19.	Lacks desire to fly.
17	18	20.	Poor in one or more of the following: a. Bombing; b. Gunnery; c. Instrument flying; d. Aerology; e. Navigation.
16	14	21.	Irresponsible, lazy, or careless. Doesn't carry through his duties promptly and properly.
15	7	22.	Just can't fly well enough.
-	24	23.	Always has excuses for anything done wrong.
-	10	24.	Dilbert. Always pulling some dumb stunt.
-	25	25.	Thinks he is a hot pilot.
-	22	26.	Lies about his experiences and cheats on his score.

"Portraits" of Wanted and Not Wanted Pilots. The characteristic ranked first in importance, both with respect to High and Low nominations, was Item 1, concerned with pilot's feeling of responsibility for others in the combat situation. In general the description of the good combat pilot, as indicated by the characteristics judged most important, might be phrased:

> "An alert man, a real leader, who feels responsible for the safety of all personnel flying in combat with him, and who is steady and reliable in the air."

It should also be noted that ability as a teamworker ranked relatively high (in seventh place) among the characteristics of "wanted" combat pilots.

In general the description of the poor, or "not wanted" combat pilot might be phrased as follows:

> "A man, erratic and undependable in the air, who flies "with his head in the cockpit" and frequently 'dopes off", who has no sense of teamwork, and who may be too worried about his own safety, or may deliberately take foolish risks, unnecessarily endangering the lives of others."

An emphasis on alertness, teamwork, emotional and social adequacy, and motivation for combat flying, as important characteristics of combat pilots, is clearly indicated.[3]

Comparison between Frequency and Importance

It will be recalled from reference to Chapter II that, for the categorizations of free response material, the agreement between frequency of use, and judged importance, was not high, the rank order coefficient being .56, and there being evident several dramatic differences in placement of certain categories in terms of frequency and importance, respectively. The same tendency was evident with respect to the checklist material, the rank order correlation between judged importance of items, and their frequency of use, as circled entries being .43 for Checklist A (Reasons for High nomination) and .20 for Checklist B (Reasons for Low nominations).[4]

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[3] As an outgrowth of the analyses of reasons for nomination, a booklet entitled "Pilots' Choice, A pilots' poll on the kind of flyer wanted in Naval Aviation" (NAVAER 00-80T-25 U S Navy) was developed. This booklet presented in entertaining and graphic form the characteristics which pilots themselves considered the important characteristics in "wanted" combat pilots, and the major drawbacks of "not wanted" pilots. This manual had wide distribution and was particularly useful in emphasizing the importance in air combat of teamwork, responsibility, and reliability as opposed to mere "hot pilot" characteristics. The material for this manual was drawn primarily from data gathered during the preliminary investigation.

[4] For all, i.e., "circled" and "uncircled" items the coefficients were .06 and -.09, respectively.

Checklist A Items. It is significant, however, that Item 1, "He feels responsible for the safety of all personnel flying in combat with him" was judged of first importance as a characteristic of the Highs, or "wanted" combat pilots, and was also most frequently used in describing the officers nominated for High. In addition, items dealing with teamwork and related characteristics ranked relatively high, both in terms of frequency of use and judged importance. However, marked differences in rank were evident for Items 11, 13, and 22 ("Gets along well"; "Easy going.."; and "Excellent plane handler"). These items were ranked higher in terms of frequency of use, than in terms of judged importance. It appears that although items pertaining to teamwork and feelings of responsibility are judged most important and also are used most frequently, other characteristics, pertaining in large part to personal attributes, are judged of less importance but are used relatively frequently in describing High nominees.

Checklist B Items. There was less agreement among judged importance and frequency of use of items employed for describing Low nominees, as indicated by the rank order coefficient of .20. Item 1 "Too worried about his own safety" was judged first in importance as a reason for nominating Low, but was the fifth in rank of frequency of use, Item 4 "Erratic, unpredictable" being most frequently used. Furthermore, there were several dramatic shifts in rank: Item 14 "Deliberately takes foolish risks" was ranked second in terms of importance, and nineteenth in terms of frequency of use. Item 10 "Won't listen to criticism" was ranked seventeenth in terms of importance, and second in terms of frequency of use. Item 3 "Tempermental, irritable, or quick tempered on the ground" was ranked seventh in terms of frequency of use, but twenty-third in terms of judged importance. Again the tendency for certain specific personality attributes to be ranked higher, in terms of frequency of use than in terms of judged importance, is evident.

Relationship between Importance for Low and Frequency of Use for High. It is of passing interest that there is a relatively high degree of correlation between judged importance of an item as a Low characteristic and the frequency of use of the converse of the Checklist B item as a circled entry in describing Highs. The rank order coefficient indicative of this relationship, excluding Items 23-26 for which no High counterparts were available, is .54.[5] Thus Item 1 "Too worried about own safety" was judged most important as a Low characteristic and the converse "...Feels responsible..." was used most frequently as a circled entry in nominating for High. Again, Item 14 "Deliberately takes foolish risks.." was ranked second in terms of importance for Lows, its converse ranking sixth in terms of frequency of use for Highs. Item 3 "No sense of teamwork,.." was ranked third in terms of importance for Lows, its converse "A team worker..." ranking second as a circled entry in terms of frequency of performance for Highs.[6]

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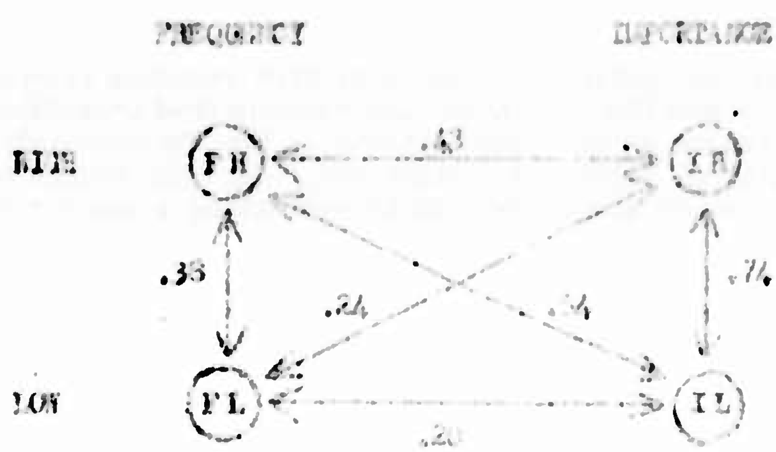
[5] However, the comparable coefficient for all items is only .17.

[6] However, the inverse of this relationship, i.e., the correlation between the judged importance of an item for High and the frequency of use of the converse of the reason as a Low item was only .24 for circled reasons, and .11 for all reasons.

Although this situation would result from chance, the relationship is sufficiently striking to indicate the need for exploration of the suggestion that whereas the relationship between frequency of use, and judged importance, of Low characteristics is negligible the relationship between the judged importance of Low characteristics and the frequency of use of the counterparts for High is considerably greater.

A possible explanation of these relationships may be made by the following rationale. Generally speaking, High nominees appeared to be acceptable in terms of a relatively large number of reasons whereas Low nominees were usually indicated as unacceptable for relatively fewer and more specific reasons. This is indicated by the fact, as noted earlier in this chapter, that more statements were used in describing High than Low nominees. Furthermore, as will be evident in Chapter VII, the intercorrelations among reasons for nomination were, in general, higher for the A list than for the B list. This would suggest that High nominees were "generally acceptable" while Low nominees were unacceptable for more restricted reasons; the reasons applying to one Low nominee not, perhaps, being applicable to another.

If this is the case the respondents may have experienced difficulty in indicating the major reasons for High nomination, and in doing so may have reviewed the negative considerations which they considered generally important with reference to Low nominees and ascribed the converse of these characteristics to the High nominee in question, as major reasons for the nomination. In the diagram below the rank order relationship between reasons for nomination for High and Low, respectively, in terms of frequency of use, and importance, respectively, are presented diagrammatically.



Examination of this diagram indicates that the relationships indicated by the rank order correlation analysis are not inconsistent with the hypothesis as stated above. It might be noted, however, that this argument might be more applicable had free response, rather than checklist material been involved.

Relationship between Free Response Categories and Checklist Items in Terms of Judged Importance and Frequency of Use

It will be recalled, through reference to Chapter II, that the categories of reasons for nomination, based on an analysis of free response material, were analyzed in terms of frequency of use, and judged importance as a characteristic of Low nominees.[7] It appears of considerable interest to examine the relationship between free response categories and checklist items in these terms.

In making this comparison it must be recognized that not all free response categories had exact analogues among the checklist items. A list of the 23 checklist items which had analogues among the free response categories, and the category number of the analogue, is presented in Table 5.7. The exact wording of the checklist items is indicated in Table 5.3, the designation of the free response categories being presented in Appendix 2-B. Eleven of the free response categories had no analogue among the checklist items. Three checklist items had no analogue among the free response categories.

Relationship between Free Response Categories and Checklist Items. The rank order correlation coefficients between checklist items and free response categories, in terms of frequency of use and judged importance are presented in Table 5.8. Inspection of this table indicates that the rank order of frequency of use of checklist items is negligibly related to the rank order of frequency of use of analogous free response categories. Only one coefficient is greater than .20, the coefficient between frequency of use of a free response category for Low and the frequency of use of analogous Checklist B item as an uncircled item being .30.

On the other hand the judged importance of free response categories as considerations in nominating a man for Low shows marked relationship with the judged importance of Checklist B items as Low characteristics, the rank order coefficient being .71. Since the judged importance of the free response categories as considerations in nominating a man for High was not determined, comparisons in these terms cannot be made. However, the rank order coefficient between judged importance of a category for Low and the judged importance of the corresponding checklist item for High was .40. It is also noteworthy in this respect that the rank order coefficient between judged importance of a free response category for Low and the frequency of use of the associated Checklist A item as uncircled reason for High nominations, was .46.

If this latter coefficient is indicative of a real relationship, an

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[7] Data on the judged importance of free response categories as characteristics of High nominees were not collected, however.

TABLE 5.7

LIST OF CORRESPONDING CHECKLIST AND FREE RESPONSE CATEGORIES

Checklist Items	Free Response Categories (Appendix 2-B)
1	13
2	24
4	100
5	16
6	11
7	4
8	23
9	1
10	5
11	102
12	6
13	101
14	3
16	8
17	103
18	7
19	21
21	12
22	2
23	9
24	22
25	10
26	17

TABLE 5.8

RANK ORDER COEFFICIENTS BETWEEN FREE RESPONSE CATEGORIES AND CHECKLIST ITEMS IN TERMS OF FREQUENCY OF USE AND JUDGED IMPORTANCE

Checklist Items	Free Response Categories		
	Freq: High	Freq: Low	Importance: Low
<u>Frequency of Use:</u> Checklist A (High) items, circled	-.05	.10	.13
<u>Frequency of Use:</u> Checklist A (High) items, uncircled	.17	.00	.46
<u>Frequency of Use:</u> Checklist B (Low) items, circled	.09	.30	-.09
<u>Frequency of Use:</u> Checklist B (Low) items, uncircled	.02	.17	.23
<u>Importance:</u> Checklist A (High) items	.09	-.35	.40
<u>Importance:</u> Checklist B (Low) items	-.02	.25	.71

explanation is not readily apparent.[8] However, the major point of interest is the indicated lack of relationship between rank order of free response categories and checklist items, in terms of frequency of use; but the suggestion of a relatively high relationship in terms of judged importance.

Possible Explanations. The explanation might, of course, lie in the differences of the techniques employed. Data gathered under the free-response techniques, and later categorized, might be considered less restricted and forced than checklist data. On the other hand the checklist analysis is based on a larger number of cases, and furthermore is not subject to the unreliability of classification which might taint the free response categorizations.

Another explanation may lie in differences in samples of subjects involved in the free response and checklist analysis. The checklist data were collected later in the war, and were gathered more exclusively in the combat areas, whereas the free response material was gathered earlier in the war and to a considerable extent from pilots returned to this country. Some selective factors may have influenced the return of combat pilots to this country and might be reflected in the data.

The relationship evident in terms of judged importance does not favor either of the explanations of lack of relationship in terms of frequency of use. Under either or both conditions the relatively high relationship in terms of judged importance could conceivably prevail. Therefore the lack of relationship in terms of frequency of use cannot definitely be ascribed either to inherent differences in the free response procedure as compared with the checklist technique, or to differences in the sample. Possibly both factors were operative.[9]

THE RELIABILITY OF NOMINATIONS IN SPECIFIC CATEGORIES

Question might well be raised regarding the reliability of the nominations in terms of specific items. This problem is of interest even though the reliability of nominations for High and Low themselves cannot necessarily be considered a mathematical function of the reliability of nominations for specific categories.

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[8] Had the coefficient involved circled reasons for High nomination, or if a relatively high relationship between judged importance for Low and frequency of use of both circled and uncircled reasons for High, the situation could be explained as noted on page 111 with reference to comparison of judged importance of checklist items for Low and frequency of use as circled items for High. However, why this relationship should be indicated for uncircled items, but not for circled, is not clear.

[9] There is some suggestion, through reference to Chapter II, that the free response categories most frequently employed deal more with references to aggressive performance and technical skill than do the checklist items most frequently used. The checklist items most frequently used appear to be more concerned with qualities of [illegible] and leadership

Procedure for Estimating Reliabilities. The reliability of nominations in terms of specific items cannot be determined exactly. Reliability coefficients can be estimated, however, through application of analysis of variance procedures. It can be assumed that a nominee, nominated for High or Low, has a "true score" for any given reason for nomination somewhere between zero and unity. An officer nominated for a certain reason by all of a universe of judges would obtain a true score of unity. An officer nominated for a certain reason by none of a universe of judges would receive a score of zero.

In terms of this assumption, analyses of variance of data from a sample of respondents can be made and the variance of nominations for a given reason i.e., item (for nominees multiply nominated) determined among nominees, within nominees and in terms of the total variance. An estimate of the reliability coefficient for a simple nomination in terms of the item in question is then represented by the function:

$$r_{1I} = 1 - \frac{\text{"within nominee" variance}}{\text{Total variance}}$$

A note on the use of this analysis of variance procedure is presented in Appendix 5-A.

Reliabilities of High and Low Items. Estimates of the reliability coefficients for the various characteristics, as represented by circled and uncircled items, respectively are presented in Table 5.9. Inspection of this table indicates that the reliabilities of given reasons for nomination for Low are in general greater (and for certain items markedly greater) than are the reliabilities of item reasons for nomination for High. Similarly, the reliability of nominations for all categories used in describing a nominee (i.e., circled and uncircled categories) is in general greater than is the reliability in terms of circled categories only. This would suggest then, not only that reasons for nomination are more reliably given for Low than for High nominations, but also that respondents do not as reliably indicate their three major reasons for a nomination as they do merely their reasons in general for the nomination. This is, of course, not out of line with expectation, since a requirement for greater specificity could be expected to reduce the reliability of the judgment.

The markedly greater reliability of nominations for Low may also lie, and apparently paradoxically, in differences in the specificity with which reasons for nomination were ascribed to High and Low nominees, respectively. As noted previously, Low nominees apparently were nominated for fewer reasons, and in terms of more specific application of these reasons, than were High nominees. In this regard, however, there was no requirement for forcing specificity (as represented by the requirement that the three outstanding reasons be selected). Thus the greater specificity with which reasons for nomination could be ascribed to Low nominees apparently resulted from the fact that Low nominees were nominated for more self evident and clear cut reasons. Thus such reasons for nomination could be expected to be more reliably given.

Absolute Value of Coefficients. It will also be noted from Table 5.9 that the absolute values of the reliability coefficients, particularly for reasons for High nominations are not large, none of the reliabilities for

TABLE 5.3

ESTIMATE OF RELIABILITY OF CATEGORY NOMINATIONS

Item No.	Categories (A List)	HIGH: Circled Only	HIGH: Circled & Un-circled	LOW: Circled Only	LOW: Circled & Un-circled	Item No.	Categories (B List)
1.	He feels responsible for the safety of all personnel flying in combat with him.	.09	.13	.19	.27	1.	Too worried about his own safety. Would save his own neck even at the expense of his squadron mates.
2.	Takes his job seriously.	.06	.13	.31	.30	2.	Hasn't grown up. Doesn't take his work seriously.
3.	Even-tempered and well-balanced on the ground.	.06	.14	.15	.26	3.	Temperamental, irritable, or quick tempered on the ground.
4.	Steady and reliable in the air.	.08	.11	.14	.25	4.	Erratic, unpredictable in the air. You can never tell what he will do next.
5.	Alert. Knows what's going on every minute in the air.	.07	.11	.12	.21	5.	Dopes off. Flies with his head "in the cockpit".
6.	Gets the word quickly and remembers well.	.09	.09	.09	.25	6.	Just doesn't get the word. Learns slowly and forgets fast.
7.	Is aggressive. Presses home the attack.	.09	.19	.32	.44	7.	Avoids or evades going on combat missions.
8.	Thinks fast enough to reach wise decisions quickly.	.05	.07	.09	.19	8.	Can't make up his mind quickly. Doesn't think fast enough to keep up with his airplane.
9.	A team-worker. You can count on him and he will count on you.	.03	.09	.14	.26	9.	No sense of teamwork. Would leave you in the lurch in order to make a name for himself.

TABLE 5 9 (Continued)

Item No.	Categories (A List)	HIGH Circled Only	HIGH Circled & Uncircled	LOW Circled Only	LOW Circled & Uncircled	Item No.	Categories (B List)
10.	Welcomes suggestions and reacts well to criticism.	.9	.09	.19	.25	10.	Won't listen to criticism. Thinks his way is always right.
11.	Gets along well with squadron mates; mixes well.	.8	.15	.18	.26	11.	Keeps to himself; doesn't mix.
12.	Accurately sizes up tactical situations.	.2	.18	.11	.12	12.	Poor at sizing up tactical situations.
13.	Easy-going and not easily excited.	.13	.16	.17	.26	13.	Nervous and tense even on the ground.
14.	Does not take foolish risks which endanger the lives of others.	.02	.08	.38	.38	14.	Deliberately takes foolish risks in his airplane, unnecessarily endangering the lives of others.
15.	Knows his airplane and its equipment.	.19	.16	.03	.20	15.	Doesn't know his airplane or equipment.
16.	Always thinks ahead and figures things out. Has a plan for any situation that is likely to come up.	.01	.10	-.02	.11	16.	Doesn't plan ahead but relies on luck. Acts first and thinks second.
17.	He is a real leader of men. Has the respect and confidence of others.	.13	.19	.13	.14	17.	Not a leader of men. Doesn't have the confidence and respect of others.

TABLE 5.9 (Concluded)

Categories (A List)	Circled Only	Circled & Un-circled	Circled Only	Circled & Un-circled	Item No.	Categories (B List)
18. Holds up well in tight spots.	.06	.05	.10	.13	18.	Likely to blow up when the going gets tough.
19. Loves to fly.	.13	.16	.16	.29	19.	Lacks desire to fly.
20. Excellent in one or more of the following: (Specify by letter). a.-Bombing b.-Gunnery c.-Instrument flying d.-Aerology e.-Navigation	.07	.13	.04	.14	20.	Poor in one or more of the following: (Specify by letter). a.-Bombing b.-Gunnery c.-Instrument flying d.-Aerology e.-Navigation
21. Carries out his responsibilities promptly and properly.	.04	.09	.16	.22	21.	Irresponsible, lazy, or careless. Doesn't carry through his duties promptly and properly.
22. Excellent plane-handler. Gets the most out of his airplane.	.12	.12	.15	.26	22.	Just can't fly well enough.
			.08	.17	23.	Always has excuses for anything done wrong.
			.08	.20	24.	Dilbert. Always pulling some dumb stunt.
			.20	.31	25.	Thinks he is a hot pilot.
			.14	.28	26.	Lies about his experience and cheats on his score.

A list items exceeding .30 in magnitude. On the other hand five of the 26 reasons for Low nominations yielded reliability coefficients in excess of .30 (for circled and uncircled categories), one coefficient (for item 7: "Avoids going on combat missions") being .44. It should be noted that these figures represent minimum estimates of reliability, however, being the estimate of the reliability for one respondent. Pooled data from a number of respondents would yield higher item reliabilities, the increase to be expected being, in general, in accord with the Spearman-Brown function.

Explanation of Differences in Reliability. There appears no general pattern explaining the variation in reliability among items. Items 7, 12, 15, and 17 were the most reliable items for High nominations; Items 7 and 14, together with 2, 19, and 25 being most reliable in connection with Low nominations. There is a suggestion that these more reliable items may be more representative of observations than of judgments, although the picture in this regard is far from clear.

It can be said, however, that reasons for nomination were more reliably ascribed in connection with Low than with High nominations, and that the reliability of circled items was less than for all descriptive items employed. Consideration of the adequacy of the coefficients as representative of absolute indices of reliability must be made with the fact in mind that the coefficients represent the reliability of reasons offered by a given respondent, and thus represent underestimates in terms of the fact that data are available for many pilots who were nominated a number of times. With this in mind the reliability of reasons for Low nomination could for most items be considered adequate. The reliability of a number of reasons for High nominations might, on the other hand, be questioned. However, as a practical matter, identification of Low nominees may be considered more important in a number of connections than identification of High nominees.

Summary of Analyses of Reasons for Nomination

The analyses of data on reasons for nomination discussed in this chapter may be summarized as follows:

1. The item most frequently used as an outstanding reason for High nomination was "Feels responsible for safety of all personnel flying in combat with him." The most frequently used "Circled"[10] reason for Low nomination was "Erratic, unpredictable...." The reason "Excellent in gunnery, etc." was least frequently used as a circled reason in nominating both Highs and Lows.

2. The agreement in terms of frequency of use between reasons for High and Low nominations was not great (rho = .25 for all reasons and .38 for "outstanding" reasons). In general, reasons most frequently used for High pertained

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[10] The respondents indicated all reasons for nomination applicable to their nominee, and then indicated the three most outstanding reasons. These latter are termed "circled" reasons for nomination.

to ability as a teamworker; for Low, to undependability. It is significant that reasons pertaining to mere technical adequacy (e.g., "Excellent in gunnery, etc.") were used, relatively, with less frequency than many others.

3. There was considerable agreement between frequency of use of reasons as circled and uncircled entries (rho = .67 for High reasons, .68 for Low). Due to the overlapping nature of these classifications, considerable agreement could be expected. However, items pertaining to certain personal characteristics, such as "Doesn't mix," "Even tempered" were used relatively infrequently as circled (or outstanding reasons) for nomination, and much more frequently as uncircled entries.

4. Difference in frequency of use of reasons for nomination, in terms of specialty classification of the nominee, was generally a reflection of difference in equipment and type of missions flown. This conclusion could be more clearly drawn, however, with reference to reasons for High, than for Low, nomination.

5. Analysis of the influence of rank of the nominee in respect to frequency of use of reasons for nomination for High, indicates that the item "....a leader of men.." was markedly more frequently used in describing Senior officers, than Junior officers. Marked differences in frequency of use of other High reasons were not evident. The converse of this High leadership item did not show marked difference in frequency of use between Junior and Senior officers as a reason for Low nomination. However, Item 2, pertaining to maturity, was relatively more frequently used as a reason for nominating Junior, than Senior, officers for Low. In addition, the items "Evades...combat missions" and "Likely to blow up" were more frequently used in connection with Senior than Junior officers nominated Low.

6. The items "Feels responsible for safety (of others)"; "Alert..."; "...a real leader," and "Steady and reliable..." were judged most important as reasons for High nomination; the items "Too worried about own safety"; "...takes foolish risks"; "No sense of teamwork" were judged most important for Low. There was greater agreement between judged importance of reasons for High and for Low, than was the case with frequency of use.

7. There was little agreement between judged importance of items and their frequency of use, although the item "Feels responsible for safety of others" was first in terms of both frequency and importance. In general, personal attributes, such as "Doesn't mix," ranked higher in terms of frequency of use than in terms of judged importance. It may be significant that the relationship between judged importance of an item for Low, and the frequency of use of the converse of the item for High, was greater than was the relationship between frequency and importance for either High or Low items, respectively.

8. Estimation of the reliability of the reasons for nomination indicated that reasons for nomination for Low were much more reliable than reasons for nomination for High.

CHAPTER VI

PREDICTION OF THE COMBAT CRITERION

The test battery employed in the selection of applicants for Naval Aviation Training during the war was validated against success in training, not only because of the obvious fact that successful completion of the flight training course was an essential step towards success in combat, but because no criterion of combat effectiveness was available.

It was early recognized, however, that degree of proficiency exhibited during flight training, above the requisite level for completing training satisfactorily, might not be correlated highly with effectiveness in combat. Basic to this possibility is the fact that success in training might be considered to demand primarily proficiency in maneuvering the plane, whereas effectiveness in combat may well demand, in addition to this skill, certain qualities of aggressiveness, leadership and responsibility not required in high degree for success in training. That these qualities are important characteristics of acceptable combat pilots has been demonstrated by the analyses presented in previous chapters.

Perhaps the primary purpose of the collection of data on combat proficiency was to make possible research on the basis of which a test battery could be developed for the selection of combat effectives. However, as a first step in such prediction research it appeared desirable to determine the relationship between tests in the selection battery used during the war (validated originally against training success) and the combat criterion.

ANALYSIS OF DATA FROM THE COMPLETE SAMPLE: PREDICTION OF HIGH AND LOW NOMINATION

Initial exploration of the relationship between test scores and the complete sample was carried out utilizing all subjects from the complete sample of 4103 "clear" cases for whom test-score data could be recovered. For such analyses test score data were available for the MCT on 2907 cases; for the MI on 3156 cases; for the PT on 2571 cases; and for the FAR on 2789 cases. Analyses were made for the sample as a whole, and in terms of subsamples relatively homogeneous in terms of rank and specialty.

These latter comparisons, in terms of rank and specialty, were made because of the evident influence of these variables on nomination status. It therefore was of importance to determine the degree to which homogeneous groups were differentiated in terms of test score. The results of such analyses are presented below.

Mechanical Comprehension Test

Complete Sample. The distributions of MCT scores for officers nominated High and Low, respectively, are presented in Table 6.1 irrespective of rank

TABLE 6.1

DISTRIBUTION OF MCT SCORES FOR HIGH AND LOW CASES FROM TOTAL SAMPLE FOR WHOM TEST DATA AVAILABLE

MCT	HIGHS		LOWS		TOTAL
Score	N	Cum. Prop.	N	Cum. Prop.	N
23	0	.000	1	.001	1
30	1	.001	0	.001	1
31	1	.001	0	.001	1
32	1	.002	1	.001	2
35	1	.003	1	.002	2
37	0	.003	5	.01	5
38	3	.004	3	.01	6
39	11	.01	15	.02	26
40	6	.02	16	.03	22
41	12	.02	19	.04	31
42	24	.04	35	.07	59
43	15	.05	29	.09	44
44	26	.07	35	.11	61
45	62	.11	59	.15	121
46	38	.13	50	.19	88
47	57	.17	70	.24	127
48	52	.20	68	.29	120
49	84	.26	81	.35	165
50	71	.31	75	.40	146
51	85	.36	82	.46	167
52	97	.43	69	.51	166
53	95	.49	97	.58	192
54	81	.54	88	.64	169
55	87	.60	70	.70	157
56	92	.66	61	.74	153
57	89	.72	59	.78	148
58	60	.76	67	.83	127
59	61	.80	40	.86	101
60	55	.84	40	.89	95
61	55	.87	26	.90	81
62	45	.90	31	.93	76
63	34	.93	32	.95	66
64	29	.95	16	.96	45
65	18	.96	16	.97	34
66	24	.97	10	.98	34
67	12	.98	10	.99	22
68	8	.99	9	.994	17
69	9	.99	4	.997	13
70	7	.996	0	.997	7
71	5	1.000	2	.999	7
72			1	.999	1
74			1	1.000	1
Total	1513		1394		2907

and specialty. Chi-squared analysis in terms of a 3 x 2 contingency table[1] yielded a chi-square of 31.12 which, for two degrees of freedom, is significant at well below the .01 level of confidence, indicating that the High and Low subjects are differentiated to a statistically significant degree in terms of MCT scores. Subjects nominated for Low tended to receive lower MCT scores than subjects nominated for High.

It should be recognized, of course, that the relatively large number of cases included in the analysis could render a relatively small amount of discrimination statistically significant. Reference to Table 6.1 indicates that, although statistically significant differentiation was achieved, the results are in themselves not of marked practical predictive significance. At no cutting score are more than 10 per cent more Low than High nominees eliminated. Nevertheless, if this differentiation can be considered unaffected by extraneous factors some promise for tests of this type, in predicting this combat criterion, would be suggested. The implications of these findings will be discussed further later in this chapter.

By Rank and Specialty Sub-Groups: Differentiation between High and Low. The results of chi-squared analysis of test score distributions by rank and specialty groups for the MCT (and also for the BI and PT) are presented in Table 6.2. Inspection of this table indicates, with reference to the MCT,

TABLE 6.2

CHI-SQUARED ANALYSIS OF TEST SCORE DISTRIBUTIONS BY RANK AND SPECIALTY GROUPS

BREAKDOWN*

Test	Single Engine Junior Officers**		Single Engine Senior Officers		Multi-Engine Junior Officers		Multi-Engine Senior Officers	
	X^2	P	X^2	P	X^2	P	X^2	P
MCT	10.88	< .01	6.22	.05-.02	25.53	< .01	.84	> .30
BI	.26	> .30	.46	> .30	3.75	.20-.10	1.92	> .30
PT	2.71	.30-.20	4.55	.20-.10	1.30	> .30	.08	> .30

*In terms of 2 x 3 contingency tables.

**Officers below the rank of Lieutenant were considered Junior Officers for the purpose of this analysis. Officers of the rank of Lieutenant and above were considered Senior Officers.

that distributions of test scores for High and Low nominees, respectively, were significantly different within three of the four sub-samples, i.e., only in the

[1]The distributions were cut between scores of 51 and 52, and between 57 and 58.

case of multi-engine Senior officers was statistically significant differentiation not evident. This is in general agreement with the analysis based on the total sample which showed some predictive significance for the test. It is also of some interest, however, that there was a suggestion that the differentiation varied significantly from sample to sample, the interaction chi-squared being 12.06, which for 6 degrees of freedom falls just below the .05 level of significance.[2]

However, except for multi-engine Junior pilots the differentiation is not marked, even though the chi-squared may be significant, as is indicated in Table 6.3. In the case of multi-engine Junior officers marked differentiation is evident. Forty-six per cent of the Lows obtained scores of less than 51 as compared to only 28 per cent of the Highs. The possibility that this represents a chance fluctuation should be recognized.

<u>By Rank and Specialty Sub-Groups: Differences in Distributions of Test Scores</u>. It is of interest to examine the incidence of subjects in various test-score ranges to determine whether the distributions of MCT scores for the various rank-specialty groups are comparable. This information may also be obtained, by inspection, from Table 6.3. There is a suggestion that the incidence of cases in the high score range is greater for Senior officers than for Junior officers, although among Single-engine officers, at these particular cutting scores, the incidence of cases in the low score range is also greater for Senior officers. To the extent that test score is a function of rank, *per se*, evidence for the discrimination of the test, based on the complete sample, can be considered somewhat spurious. On the other hand the fact that some discrimination was evident in terms of rank-specialty sub-groups suggests that this spurious factor does not account completely for the effect.

<u>Biographical Inventory</u>

<u>Complete Sample</u>. The distributions of BI scores for High and Low nominated officers are presented in Table 6.4. Chi-squared analysis in terms of a 3 x 2 contingency table[3] yielded a chi-square of 1.58, which is far from the level of statistical significance (being between the .50 and .30 levels.) High and Low nominees clearly are not differentiated in terms of their BI scores. Examination of Table 6.4 indicates that at no score level is the difference between the proportions of High and Low nominees falling below that score level greater than .02. This finding suggests little utility for the training key of the BI in predicting this combat criterion, unless, of course, this lack of prediction could be explained on the basis of extraneous factors.

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[2]The interaction chi-squared is equal to the difference between the total chi-squared (sum of the individual chis-squared over the four samples) and the pooled chi-square (the chi-squared based on data from the four samples pooled, i.e., the total sample). See Snedecor, G. W. <u>Statistical Methods</u>. Ames, Iowa: The Iowa State College Press, 1946.

[3]The distributions were cut between scores of 14 and 15, and between 38 and 39.

TABLE 6.3

PROPORTION OF SUBJECTS FALLING AT VARIOUS SCORE LEVELS OF MCT TEST OVER FOUR SPECIALTY-RANK CLASSIFICATIONS

Single Engine — Junior

Score Range	Prop. Highs	Prop. Lows	N Total
30-43	.05	.08	86
44-57	.70	.73	960
58-71	.25	.19	133
Total	1.00	1.00	1344

$\chi^2 = 10.83$

P = < .01

Single Engine — Senior

Score Range	Prop. Highs	Prop. Lows	N Total
31-47	.15	.25	77
48-58	.53	.52	221
59-71	.31	.23	122
Total	.99	1.00	420

$\chi^2 = 6.22$

P = .05-.02

Multi-Engine — Junior

Score Range	Prop. Highs	Prop. Lows	N Total
35-50	.27	.46	151
51-59	.58	.34	203
60-72	.15	.20	75
Total	1.00	1.00	429

$\chi^2 = 25.53$

P = < .01

Multi-Engine — Senior

Score Range	Prop. Highs	Prop. Lows	N Total
35-47	.20	.25	45
48-59	.57	.55	115
60-71	.23	.20	45
Total	1.00	1.00	205

$\chi^2 = .84$

P = > .30

TABLE 6.4

FREQUENCY DISTRIBUTION OF BI SCORES
FOR HIGHS AND LOWS
(Total Sample N = 3156)

BI Score	HIGHS N	HIGHS Cum. Prop.	LOWS N	LOWS Cum. Prop.	TOTAL N
54 - 62	1	1.000	1	1.000	2
51 - 53	2	.999	1	.999	3
48 - 50	4	.998	4	.999	8
45 - 47	10	.995	10	.996	20
42 - 44	27	.99	23	.99	50
39 - 41	39	.97	48	.97	87
36 - 38	79	.95	70	.94	149
33 - 35	110	.90	82	.89	192
30 - 32	120	.84	108	.84	228
27 - 29	157	.77	133	.76	290
24 - 26	180	.67	136	.68	316
21 - 23	197	.57	170	.58	367
18 - 20	165	.45	162	.47	327
15 - 17	171	.35	155	.36	326
12 - 14	137	.25	125	.25	262
9 - 11	108	.17	104	.17	212
6 - 8	70	.11	66	.10	136
3 - 5	41	.06	28	.05	69
0 - 2	34	.04	28	.03	62
-3 - -1	18	.02	12	.01	30
-6 - -4	8	.01	5	.004	13
-10 - -7	6	.004	1	.001	7
Total	1684		1472		3156

By Rank and Specialty Sub-Groups: Differentiation between High and Low. Reference back to Table 6.2 indicates that in none of the sub-samples were the distributions of BI scores for High and Low nominees, respectively significantly different. In three of the four samples the chi-squares carried p values greater than .30; for one sample the p value lay between .20 and .10. These findings are in agreement with the findings from the analysis of data from the entire sample, which did not indicate predictive significance for this test, using the "training key".

It is of interest, particularly with reference to developments to be discussed subsequently in this chapter, that such differentiation as was indicated, although in no case significant, was in different directions for Junior and for Senior officers, respectively. For Junior officers, both Single-engine and Multi-engine, the incidence of High nominees falling in the upper test score range was slightly greater than in the case of Low nominees. However, for Senior officers, both Single and Multi-engine, this relationship was reversed: i.e., the incidence of High nominees falling in the upper test score range was slightly lower than was the incidence of Low nominees.

Differences in Distributions of Test Scores by Rank and Specialty. The distribution of BI scores by rank and specialty among High and Low nominees, respectively, over the four sub-samples was significantly different, chi-squared analysis of two 3 x 4 contingency tables yielding chis-squared of 21.75 and 15.65. As is evident from Table 6.5, Senior officers tended to be characterized by greater incidence of scores in the low range than did Junior officers, and perhaps a slightly lower incidence in the upper score range. Moreover, there appears a rather marked tendency for the incidence of scores in the low range to be greater for Multi-engine than for Single-engine pilots. These findings obviously reflect differences in the make-up of the sub-samples. The fact that Senior pilots were in general older might well explain the difference in incidence of scores among Senior and Junior pilots. The difference between Single-engine and Multi-engine pilots is not so readily explained, however. In any event the tendency for higher ranking officers to obtain lower BI scores explains the shift in the direction of prediction among Junior and Senior officers, respectively, as discussed above, inasmuch as "Senior" officers tended to be nominated for High more often than Junior officers, but tended to receive lower BI scores.

The Personnel Test

Complete Sample. The distributions of PT scores for High and Low nominees are presented in Table 6.6. Chi-squared analysis in terms of a 3 x 2 contingency table[4] yielded a chi-square of 7.71, statistically significant at just below the .02 level of confidence. Thus, a modicum of predictive significance is suggested for this test, with Low nominees tending to receive lower scores on the test, although inspection of Table 6.6 indicates that the difference in proportion of subjects falling below any given score level is never greater than .07. This amount of discrimination cannot be considered

[4] The distributions were cut between scores of 22 and 23, and between 34 and 35.

TABLE 6.5

RI SCORES, FOR HIGH AND LOW SUBJECTS, BY RANK-SPECIALTY BREAKDOWN

	HIGHS								LOWS							
	Single Engine				Multi-Engine				Single Engine				Multi-Engine			
	Junior		Senior		Junior		Senior		Junior		Senior		Junior		Senior	
Score Range	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Less than 15	116	.18	119	.29	65	.28	65	.34	137	.21	52	.26	51	.28	35	.37
15-28	329	.52	193	.48	111	.48	84	.44	320	.50	101	.50	92	.50	41	.43
29 +	192	.30	92	.23	55	.24	41	.22	189	.29	48	.24	41	.22	19	.20
Total	637	1.00	404	1.00	231	1.00	190	1.00	646	1.00	201	1.00	184	1.00	95	1.00

HIGHS: $X^2 = 21.75$, $P = < .01$

LOWS: $X^2 = 15.65$, $P = .02 - .01$

TABLE 6.6

DISTRIBUTION OF PT SCORES FOR HIGH AND LOW CASES
FROM TOTAL SAMPLE FOR WHOM TEST DATA AVAILABLE

PT	HIGHS		LOWS		TOTAL
Score	N	Cum. Prop.	N	Cum. Prop.	N
10	1	.001			1
13	3	.003			3
14	1	.004			1
15	1	.004	1	.001	2
16	4	.01	8	.01	12
17	10	.01	4	.01	14
18	15	.03	16	.02	31
19	14	.04	22	.04	36
20	27	.05	32	.07	59
21	36	.08	27	.09	63
22	45	.11	37	.12	82
23	55	.15	72	.19	127
24	62	.20	63	.24	125
25	77	.25	90	.32	167
26	99	.32	79	.38	178
27	96	.39	80	.45	176
28	88	.46	92	.53	180
29	104	.53	80	.60	184
30	32	.59	80	.66	162
31	96	.66	71	.72	167
32	85	.72	69	.78	154
33	79	.78	51	.83	130
34	77	.83	53	.87	130
35	49	.87	48	.91	97
36	53	.91	25	.93	78
37	25	.92	20	.95	45
38	23	.94	18	.96	41
39	22	.96	8	.97	30
40	18	.97	9	.98	27
41	16	.98	12	.99	28
42	11	.99	4	.99	15
43	9	.99	2	.99	11
44	4	.997	3	.997	7
45	1	.998			1
46	1	.999	3	.999	4
47	1	.999			1
48	1	.1000	1	.1000	2
Total	1391		1180		2571

TABLE 6.7

PT SCORES, FOR HIGH AND LOW SUBJECTS,
BY RANK-SPECIALTY BREAKDOWN

	HIGHS								LOWS							
	Single Engine				Multi-Engine				Single Engine				Multi-Engine			
Score Range	Junior N	%	Senior N	%	Junior N	%	Senior N	%	Junior N	%	Senior N	%	Junior N	%	Senior N	%
less than 25	151	.29	63	.19	66	.36	23	.14	184	.33	38	.27	44	.33	12	.16
26-33	293	.56	193	.57	92	.50	89	.54	303	.54	76	.54	67	.51	41	.55
34 +	83	.16	83	.24	27	.15	53	.32	70	.13	26	.19	21	.16	22	.29
Total	527	1.01	339	1.00	185	1.01	165	1.00	557	1.00	140	1.00	132	1.00	75	1.00

Highs: $X^2 = 48.91$, $P = < .01$

Lows: $X^2 = 20.74$, $P = < .01$

to have marked practical significance, even assuming that the discrimination evident is not a function of extraneous factors.

<u>By Rank and Specialty Sub-Groups: Differentiation between High and Low.</u> Reference back to Table 6.2 indicates that there is no suggestion of differentiation between Highs and Lows, respectively, in terms of FT scores in any of the four sub-samples. This is in contrast to the result of the analysis for the group as a whole, analysis of which yielded a chi-square significant at approximately the .02 level of confidence. It appears probable that the suggestion of differentiation indicated by the analysis of data from the entire sample is the result of an artefact.

<u>By Rank and Specialty Sub-Groups: Differences in Distribution of Test Scores.</u> That the nature of the artefact may lie in the differences in FT scores over the various sub-samples is indicated by examination of Table 6.7. It is evident that among High and Low nominees, the incidence of cases in the various score ranges is markedly different over the four rank-specialty sub-samples. It will be noted first that there is a markedly greater incidence of cases in the Low score range among Junior as compared to Senior officers. This probably reflects the lowering of selection standards in about 1943. While this difference in incidence is evident among both High and Low nominees, there were relatively more Junior officers than Senior officers nominated for Low. This being the case, it is evident that, in pooling relatively heterogeneous data from four sub-groups, a spurious indication of test-criterion contingency could be obtained. There is no clear trend, however, with reference to the Multi-engine -- Single-engine comparison, and the number of cases is too limited to hazard interpretations as to possible "interaction" between test score and Junior-Senior Multi-single engine classifications.

<u>The Flight Aptitude Rating</u>

The Flight Aptitude Rating represented a combination of the BI and MCT scores, generally expressed in terms of letter grades from A to E, "A" representing the high end of the scale. The number of High and Low nominees at each grade level is presented in Table 6.3. The chi-squared of 16.88 yielded by analysis in terms of a 2 x 5 contingency table is significant, with four degrees of freedom, at below the .01 level of confidence, although examination of Table 6.8 indicates that at no grade level is the difference between pro-

TABLE 6.8

DISTRIBUTION OF FAR SCORES FOR HIGH AND LOW CASES FROM TOTAL SAMPLE FOR WHOM TEST DATA AVAILABLE

FAR Score	HIGHS N	HIGHS Cum. Prop.	LOWS N	LOWS Cum. Prop.	TOTAL N
A	415	1.000	354	1.000	769
B	309	.71	226	.73	535
C	455	.50	440	.57	895
D	191	.19	232	.24	423
E	84	.06	83	.06	167
Total	1454		1335		2789

portion of Highs and Lows falling below that score level greater than .07. Thus in predicting this combat criterion, the FAR proved less discriminating than did the MCT alone. This is not surprising due to the lack of relationship between BI scores and the criterion.

Analysis of FAR distributions in terms of rank and specialty sub-samples was not made, since the constituents of the FAR (the MCT and the BI) were treated individually.

Summary Considerations

The analyses based on all cases, some suggestion of predictive value was evident for the MCT and possibly also for the PT, the discrimination between distributions of scores on these two tests meeting acceptable levels of statistical significance, particularly in the case of the MCT. The BI, scored in terms of the training key, demonstrated no differentiation, and the differentiation exhibited by the other two tests did not reach a level of much practical significance.

Moreover, the analysis of data on the basis of rank-specialty sub-sample breakdowns suggests that the indication in terms of the complete sample of possible (although limited) predictive significance for the MCT may be warranted, but that the suggestion of predictive significance for the PT was probably spurious. On the basis of these analyses of High and Low nomination, the only measure showing even limited promise (in terms of the keys routinely employed) in the prediction of this combat criterion is the MCT. As noted previously, this indication is of considerable academic, but of little practical, significance.

ANALYSIS OF DATA FROM THE COMPLETE SAMPLE: PREDICTION OF REASON FOR NOMINATION

The discussion of predictive value of the tests has been concerned, up to this point, solely with the prediction of High or Low nomination. It is of significance to inquire whether there is a relationship between test score and reason for nomination. Analyses in these terms were conducted on the basis of data from the complete sample. The significance of the contingency between test score and nomination for specific reasons was determined (through chi-squared analysis) in terms of the following comparisons:

1. Highs nominated for a specific circled reason vs. Lows nominated for the converse of the specific reason (circled) in question (e.g., High cases for whom A list reason 1 was circled as a reason for nomination vs. Low cases for whom B list reason 1 was circled as a reason for nomination.)

2. Highs nominated for a specific uncircled reason vs. Lows nominated for the converse of the specific reason (uncircled) in question (e.g., High cases for whom A list reason 1 was given either circled or uncircled, vs. Low cases for whom B list reason 1 was given either circled or uncircled.)

3. Highs nominated for a specific circled reason vs. all other Highs not nominated for the reason in question, i.e., "Category placement vs. Non-category placement."

4. Highs nominated for a specific uncircled reason vs. all other Highs not nominated for the reason in question.

5. Lows nominated for a specific circled reason vs. all other Lows not nominated for the reason in question.

6. Lows nominated for a specific uncircled reason vs. all other Lows not nominated for the reason in question.

The data, as noted previously, were treated by Chi-Squared, in general in terms of 2 x 3 contingency tables, i.e., the test score distributions were trichotomized.

The results of these analyses cannot be considered too definitive, inasmuch as data from the complete sample were treated, and the results are undoubtedly influenced by extraneous factors associated with rank and specialty. The paucity of cases nominated for individual reasons rendered inadvisable treatment of the data in terms of rank-specialty breakdowns, particularly since, as will be discussed in the next chapter, the results of the factor analysis have important implication for more meaningful research involving reason for nomination data. However, it appears desirable to present the tables of chi-squared values yielded by the comparisons outlined above, with brief discussion. It should be recognized, however, that these results are undoubtedly influenced to some degree by uncontrolled factors.

Mechanical Comprehension Test

The results of the chi-squared analyses involving the Mechanical Comprehension Test are presented in Table 6.9.

Highs vs. Lows. Examination of the first two columns of this table indicates that test score was rather generally related to the bulk of reasons for nomination; specifically with 16 of the 22 reasons as circled entries, and with all but one of the uncircled reasons, at below the .01 level of confidence. It is of interest to note that in general prediction was in the expected direction, i.e., the incidence of cases in the upper score range was greater for Highs than for Lows, and less for Highs than for Lows in the bottom score range.

Category Placement vs. Non-Category Placement. Nomination, or failure to be nominated, for specific reasons, as either a High or a Low, respectively, was not predicted as well as was the case with the comparison involving Highs versus Lows, as inspection of the last four pairs of columns of Table 6.9 will indicate. Among the High nominees, the MCT discriminated between men nominated for item 5 ("Alert ....") as either a circled or an uncircled reason, the p value resulting from these analyses being below .02. As circled entries, items

TABLE 6.9

MCT: PREDICTION OF REASONS FOR NOMINATIONS*

Reasons	Circled Reasons HIGH vs LOW X^2	P	Uncircled Reasons HIGH vs LOW X^2	P	Circled HIGH Cat. vs not Cat. X^2	P	Uncircled HIGH Cat. vs not Cat. X^2	P	Circled LOW Cat. vs not Cat. X^2	P	Uncircled LOW Cat. vs not Cat. X^2	P
1	6.09	.05-.02	26.19	<.01	1.21	>.30	2.57	.30-.20	.28	>.30	3.21	.30-.20
2	16.64	<.01	38.63	<.01	.15	>.30	2.72	.30-.20	4.46	.20-.10	7.67	<.01[b]
3	1.47	>.30	24.45	<.01	1.81	>.30	7.71	.05-.02	2.93	.30-.20	.98	>.30
4	20.68	<.01	28.56	<.01	5.29	.10-.05	3.48	.20-.10	.55	>.30	.28	>.30
5	12.61	<.01	36.62	<.01	5.02	.02-.01	14.98	<.01	2.23	>.30	1.95	>.30
6	15.19	<.01	41.82	<.01	1.82	>.30	4.39	.20-.10	5.30	.10-.05	8.36	.02-.01[b]
7	12.24	<.01	24.10	<.01	4.84	.10-.05	6.20	.05-.02	.98	>.30	2.23	>.30
8	8.45	.02-.01	22.51	<.01	4.23	.20-.10	10.74	<.01	.14	>.30	3.18	.30-.20
9	8.11	.02-.01	15.56	<.01	.91	>.30	.45	>.30	.97	>.30	.42	>.30
10	3.86	.20-.10	20.38	<.01	1.51	>.30	.15	>.30	1.53	>.30	.14	>.30
11	3.93	.02-.01[a]	7.79	.05-.02[a]	4.24	.20-.10	.00	>.30	8.50	.02-.01	21.19	<.01
12	7.79	.05-.02	35.54	<.01	1.06	>.30	15.13	<.01	1.11	>.30	.70	>.30
13	14.10	<.01	30.03	<.01	.45	>.30	9.39	<.01	4.32	.20-.10	4.74	.10-.05
14	1.25	>.30	12.85	<.01	2.27	>.30	.61	>.30	.83	>.30	.14	>.30
15	9.03	.02-.01	38.00	<.01	8.47	.02-.01	5.59	.10-.05	1.81	>.30	6.97	.05-.02[b]
16	4.25	.20-.10	35.19	<.01	8.47	.02-.01	9.53	<.01	.83	>.30	3.35	.20-.10
17	7.88	.02-.01	27.74	<.01	1.36	>.30	1.66	>.30	2.64	.30-.20	1.39	>.30
18	9.02	.02-.01	43.77	<.01	4.09	.20-.10	21.79	<.01	1.11	>.30	8.64	.02-.01[b]
19	15.07	<.01	34.91	<.01	1.97	>.30	5.75	.10-.05	2.37	>.30	4.04	.20-.10
20	12.53	<.01	41.40	<.01	4.09	.20-.10	9.38	<.01	4.18	.20-.10	5.86	.10-.05
21	8.30	.02-.01	37.44	<.01	.15	>.30	4.08	.20-.10	1.95	>.30	7.95	.02-.01[b]
22	12.39	<.01	30.61	<.01	3.48	.20-.10	7.11	.05-.02	.14	>.30	2.65	.30-.20
23									1.67	>.30	3.90	.20-.10
24									6.55	.05-.02[b]	13.52	<.01[b]
25									.14	>.30	.28	>.30
26									3.76	.20-.10	1.98	>.30
All Cases	31.10		31.10									

*Direction of prediction such that high scores are associated with High nomination except as noted otherwise:
"a" denotes middle range scores associated with High nomination.
"b" denotes low range scores associated with High nomination.

15 and 16 of the A list ("Knows his airplane ....", and "Thinks ahead") were also discriminated, in all these situations the incidence of high scores among officers nominated for these reasons being greater than among those not nominated. Six other items (8, 12, 13, 16, 18 and 20) yielded chis-squared with an associated p value below .02 as uncircled entries.

Among Low nominees, the MCT discriminated between men nominated for item 11 (" ... doesn't mix") as either a circled or an uncircled reason (the chis-squared carrying p values of less than .02) and also in terms of item 24 (a "Dilbert"), although as a circled entry the p value for this item was between .05 and .02. Four other items (6, 11, 18 and 21) also were discriminated as uncircled items. In general, for the comparisons involving Lows nominated for given reasons vs. those nominated for other reasons, the incidence of test scores in the low range was greater among pilots nominated Low for the reason in question than for other reasons. This finding is, of course, altogether reasonable. However, for item 11 (" .... doesn't mix") Low nominees nominated for this reason tended to get higher MCT scores than Low nominees nominated for other reasons (in terms of use of the item as either a circled or an uncircled entry.) This point is of some interest.

The Biographical Inventory

The results of the chi-squared analysis involving the Biographical Inventory are presented in Table 6.10.

Highs vs. Lows: It will be recalled, from reference to a previous section in this chapter, that the Biographical Inventory was not related significantly to High and Low nomination, either with reference to the sample as a whole or to sub-samples relatively homogeneous in terms of rank and age. Inspection of Table 6.10 indicates, as might be expected, that the BI did not, in general, predict nomination for specific reasons. However, as indicated in this table, the contingency between BI scores and certain reasons for nomination as a High or Low was statistically significant.

Specifically, in regard to use as circled or an uncircled reason for nomination, the BI score was apparently significantly related to item 2 ("Takes his job seriously" vs. "Hasn't grown up") at below the .05 level. Items 9 and 21 (relating to "teamwork" and "taking responsibilities seriously", respectively) as uncircled items yielded chis-squared significant at below the .02 level, and items 10 and 16 yielded chis-squared significant at below the .05 level as uncircled items.

Lacking any cross-validation evidence, it cannot be said that the Biographical Inventory predicts particularly well these particular reasons for nomination. The findings might, however, be considered somewhat suggestive, although the possibility should be recognized that they might have resulted from uncontrolled factors associated with rank or specialty.

Category Placement vs. Non-Category Placement. Reference to Table 6.10 indicates that in terms of a number of reasons for nomination BI score apparently discriminated, among Highs and Lows respectively, subjects nominated

TABLE 6.10

BI: PREDICTION OF REASONS FOR NOMINATIONS*

Reasons	Circled Reasons HIGH vs LOW X^2	P	Uncircled Reasons HIGH vs LOW X^2	P	Circled HIGH Cat. vs not Cat. X^2	P	Uncircled HIGH Cat. vs not Cat. X^2	P	Circled LOW Cat. vs not Cat. X^2	P	Uncircled LOW Cat. vs not Cat. X^2	P
1	5.66	.10-.05b	3.21	.20	5.22	.10-.05b	0.00	> .30	1.03	> .30	2.65	.30-.20
2	8.80	.02-.01b	8.54	.02-.01b	.16	> .30	2.02	> .30	11.33	< .01	11.04	< .01
3	.90	> .30	3.54	.20-.10	.67	> .30	.34	> .30	1.03	> .30	5.74	.10-.05
4	1.92	> .30	2.26	> .30	1.85	> .30	5.22	.10-.05	3.83	.20-.10	1.77	> .30
5	1.18	> .30	1.18	> .30	1.18	> .30	3.54	.10-.05	2.94	.30-.20	1.91	> .30
6	2.51	.30-.20	1.10	> .30	3.70	.20-.10	.34	> .30	0.59	> .30	1.77	> .30
7	5.31	.10-.05a	3.52	.20-.10	10.27	< .01	11.45	< .01	1.91	> .30	.59	> .30
8	1.72	> .30	2.66	.30-.20	1.18	> .30	2.02	> .30	1.03	> .30	2.36	> .30
9	1.46	> .30	9.92	< .01b	2.02	> .30	.16	> .30	4.27	.20-.10	16.93	< .01
10	4.86	.10-.05b	7.62	.05-.02	1.68	> .30	.16	> .30	3.83	.20-.10	16.93	< .01
11	1.34	> .30	2.63	.30-.20	.34	> .30	1.52	> .30	2.35	> .30	2.65	.30-.20
12	.17	> .30	0.00	> .30	4.21	.20-.10	2.86	.30-.20	3.09	.30-.20	1.32	> .30
13	.10	> .30	1.93	> .30	0.00	> .30	1.01	> .30	.74	> .30	1.62	> .30
14	7.56	.05-.02b	15.54	< .01b	7.40	.05-.02b	4.54	.20-.10	3.68	.20-.10	14.87	< .01
15	1.92	> .30	0.35	> .30	.16	> .30	1.52	> .30	1.52	> .30	2.06	> .30
16	1.20	> .30	6.63	.05-.02b	.34	> .30	7.40	.05-.02	1.77	> .30	6.04	.05-.02
17	2.88	.30-.20	4.20	.20-.10	2.18	> .30	.50	> .30	.15	> .30	6.33	.05-.02
18	1.44	> .30	0.57	> .30	3.87	.20-.10	5.89	.10-.05	.59	> .30	1.03	> .30
19	4.88	.10-.05	3.80	.20-.10	6.06	.05-.02	7.24	.05-.02	1.32	> .30	3.09	.30-.20
20	5.81	.10-.05a	0.81	> .30	1.01	> .30	2.52	.30-.20	5.45	.10-.05	1.47	> .30
21	1.33	> .30	8.46	.02-.01b	1.68	> .30	2.18	> .30	2.21	> .30	10.75	< .01
22	1.15	> .30	1.54	> .30	2.52	.30-.20	4.54	.20-.10	.29	> .30	2.06	> .30
23									6.29	.05-.02	42.49	< .01
24									.92	> .30	.97	> .30
25									18.13	< .01	34.10	< .01
26									1.34	> .30	16.56	> .30
All Cases	1.58		1.58									

*Direction of prediction (for P values less than .10) such that high scores are associated with High nomination except as noted otherwise:
"a" denotes middle range scores associated with High nomination.
"b" denotes low range scores associated with High nomination.

for a specific reason vs. subjects not nominated for the reason in question, based on data from the complete sample. However, since especially in the case of the BI data from the complete sample are suspect, and since for reasons noted above the complete analysis has not been extended to cover the individual sub-samples, drawing of specific conclusions is clearly unwarranted.

Nevertheless, one point might be noted in passing. It will be recalled that, with reference to the MCT, for items with regard to which the contingency between score and nominated vs. not nominated breakdown approached statistical significance, High subjects nominated for the reason in question tended to obtain higher MCT scores than did High subjects nominated for other reasons, whereas Low subjects nominated for a specific reason tended to get lower scores than Low subjects nominated for other reasons. This finding is not unreasonable. However, with reference to the BI analysis based on the complete sample, both High and Low subjects, respectively, nominated for specific reasons, tend to obtain higher BI scores than do subjects nominated for other reasons.

Direction of Prediction. In this connection one fact is particularly noteworthy; namely that with reference to all contingencies significant at below the .05 level of confidence, the prediction was in a direction opposite to that expected, i.e., the incidence of scores in the low range was greater among High than among Low nominees. This clearly might reflect an artefact, however, since as noted previously higher ranking pilots tend to obtain lower scores on the BI but to receive a disproportionate number of High nominations.

Prediction in Rank-Specialty Sub-Groups. To explore the possibility that this evidence of "negative prediction" was in reality due to an artefact, the distributions by sub-groups of BI scores of pilots nominated High and Low were compared for reasons 2 and 14 as circled items, and for reasons 2, 9, 10, 14, and 16 as uncircled items[5] despite the small number of cases involved. These dichotomous breakdowns of the BI distributions in terms of sub-groups are presented in Table 6.11 for circled items and in Table 6.12 for uncircled items.

For only one of the breakdowns in the two tables (Item 2, uncircled, for Single Engine Senior officers) is a chi-squared yielded which is significant at below the .05 level and generalization regarding trends is difficult due to the paucity of cases in some of the breakdowns. However, certain trends are suggestive, even though differences are not statistically significant. For all but one of the breakdowns involving Senior pilots the greatest incidence of cases (in either the High or Low distributions respectively) falls in the upper left hand cell of the four-fold contingency table. This

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[5]As reference to Table 6.10 indicates, the contingencies for all of these items were significant at below the .05 level. Item 21 as an uncircled entry also yielded a chi-squared significant at below the .02 level, but data in terms of the rank-specialty breakdown were not available.

TABLE 6.11

BREAKDOWN OF BI DISTRIBUTION BY RANK
AND SPECIALTY FOR SELECTED CIRCLED ITEMS

Item Sub-Sample		2 High	2 Low	14	14 High	14 Low
Single Engine Senior	23-	52 (62)	12 [illegible]	23-	92 (66)	10 (56)
	24+	36 (37)	11 (48)	24+	47 (34)	8 (44)
		98	23		139	18
Multi-Engine Senior	23-	36 (65)	6 (60)	16-	27 (48)	5 (56)
	24+	19 (35)	4 (40)	17+	29 (52)	4 (44)
		55	10		56	9
Single Engine Junior	23-	56 (43)	64 (51)	23-	49 (48)	31 (44)
	24+	74 (57)	62 (49)	24+	54 (52)	39 (56)
		130	126		103	70
Multi-Engine Junior	23-	38 (58)	24 (56)	24-	35 (67)	7 (50)
	24+	28 (42)	19 (44)	25+	17 (33)	7 (50)
		66	43		52	14

*Red figures denote percentages of High or Low nominees.

TABLE 6.12

BREAKDOWN OF BI DISTRIBUTION BY RANK
AND SPECIALTY FOR SELECTED UNCIRCLED ITEMS

Item / Sub Spie		2 High	2 Low		9 High	9 Low		14 High	14 Low		10 High	10 Low		16 High	16 Low
S.E. Sr.	22-	190 (60)	25 (42)				22-	199 (58)	28 (54)	22-	172 (59)	70 (55)	22-	162 (59)	27 (56)
	23+	129 (40)	34 (58)				23+	143 (42)	24 (46)	23+	122 (41)	57 (45)	23+	113 (41)	29 (44)
		319	59					342	52		294	127		275	56
M.E. Sr.	22-	102 (62)	21 (57)	23-	99 (61)	22 (51)	22-	95 (64)	11 (50)	22-	74 (61)	36 (60)	22-	82 (60)	13 (46)
	23+	62 (38)	16 (43)	24+	56 (39)	21 (49)	23+	53 (36)	11 (50)	23+	47 (39)	24 (40)	23+	55 (40)	15 (54)
		164	37		145	43		148	22		121	60		137	28
S.E. Jr.	22-	216 (45)	164 (52)	23-	258 (46)	126 (44)	22-	204 (46)	99 (48)	22-	191 (45)	189 (46)	22-	136 (47)	126 (46)
	23+	263 (55)	154 (48)	24+	298 (54)	159 (56)	23+	242 (54)	108 (52)	23+	228 (54)	218 (54)	23+	153 (53)	147 (54)
		479	318		556	285		446	207		419	407		289	273
M.E. Jr.	22-	103 (55)	48 (52)	20-	105 (57)	42 (54)	22-	97 (58)	18 (45)	22-	81 (57)	57 (50)	22-	62 (52)	33 (51)
	23+	83 (45)	44 (48)	21+	79 (43)	36 (46)	23+	71 (42)	22 (55)	23+	61 (43)	57 (50)	23+	58 (48)	32 (49)
		186	92		184	78		168	40		142	114		120	65

*Red figures denote percentages of High (or Low) nominees.

suggests that the incidence of Low BI scores tends to be greatest among senior pilots nominated for High. This trend is also evident for the Multi-engine Junior officers. No trend is evident from examination of the Single-engine Junior officer breakdowns.

In general, items for which a significant contingency was evident between BI score and nomination for a specific reason on the basis of the entire sample did not yield indications of marked contingency with reference to sub-samples homogeneous in terms of rank and specialty.

The Personnel Test

The results of the chi-squared analysis involving the Personnel Test are presented in Table 6.13.

Highs vs. Lows. Analysis of nomination data from all subjects with regard to placement as a High or Low indicated, as reference back to Table 6.6 and the associated discussion will show, a significant relationship or contingency between PT score and nomination for High or Low. However, that this indication was spurious is suggested by the fact that in terms of individual rank-specialty sub-samples no significant contingency was found (See Table 6.2).

Therefore, in view of the indicated, but spurious, contingency between PT score and nomination, on the basis of the entire sample, it is not surprising (as reference to Table 6.13 will indicate) that 13 of the 22 reasons for nomination yielded chi's-squared significant at less than the .05 level as uncircled items, with 8 of the 22 yielding p values of this order as circled items. The following items yielded chis-squared significant at below the .02 level as circled items: 2, 4, 5, 6, 17, and 20, with items 12 and 15 yielding chis-squared significant at below .02. All these reasons were also significant at below the .05 level as uncircled items, items 1, 8, 9, 12, 14, 16, and 21 in addition being significant at this level of confidence.

Category Placement vs. Non-Category Placement. Inspection of Table 6.13 indicates that some items yielded chis-squared significant at below the .05 level in terms of category placement vs. non-category placement. Because of the known element of spuriousness involved in the PT contingency tables based on data from the entire group, and because detailed analysis in terms of rank-specialty sub-groups has not been made, the significance of the indication of differential prediction among High and Low subjects respectively could only be determined by analysis in terms of more homogeneous sub-samples, and in terms of a cross-validation test. Therefore, it can only be noted that analysis of data from the entire group indicated certain significant contingencies in terms of "category placement vs. non-category placement," but that the possible spurious nature of these indications has not been evaluated.

Prediction in Rank-Specialty Sub-Samples. It would be desirable, of course, to examine the prediction of reasons for nomination over the rank-specialty sub-samples. For reasons discussed in connection with the other

TABLE 6.13

PT: PREDICTION OF REASONS FOR NOMINATIONS*

Reasons	Circled Reasons HIGH vs LOW X^2	P	Uncircled Reasons HIGH vs LOW X^2	P	Circled HIGH Cat. vs not Cat. X^2	P	Uncircled HIGH Cat. vs not Cat. X^2	P	Circled LOW Cat. vs not Cat. X^2	P	Uncircled LOW Cat. vs not Cat. X^2	P
1	2.72	.20-.30	6.29	.05-.02	4.87	.10-.05	1.67	> .30	.59	> .30	0.47	> .30
2	14.19	< .01	13.06	< .01	3.76	.20-.10	2.36	> .30	5.07	.10-.05[b]	5.66	.10-.05
3	.33	> .30	1.92	> .30	.70	> .30	.28	> .30	1.65	> .30	2.60	.30-.20
4	8.87	.02-.01	9.87	< .01	.56	> .30	1.25	> .30	4.01	.20-.10	6.14	.05-.02
5	10.67	< .01	14.29	< .01	8.21	.02-.01	8.90	.02-.01	.94	> .30	3.66	.20-.10
6	12.64	< .01	25.18	< .01	4.17	.20-.10	16.00	< .01	8.50	.02-.01[b]	10.50	< .01[b]
7	3.54	.20-.10	3.33	.20-.10	2.64	.30-.20	4.87	.10-.05	3.54	.20-.10	2.48	.30-.20
8	3.56	.20-.10	8.00	.02-.01	3.06	.30-.20	2.64	.30-.20	.59	> .30	.71	> .30
9	3.46	.20-.10	6.71	.05-.02	1.39	> .30	.14	> .30	3.19	.30-.20	1.30	> .30
10	4.73	.10-.05	4.98	.10-.05	3.06	.30-.20	.56	> .30	2.24	> .30	.24	> .30
11	1.95	> .30	3.30	.20-.10	4.31	.20-.10	.83	> .30	3.54	.20-.10	1.42	> .30
12	7.65	.05-.02	15.99	< .01	4.87	.10-.05	15.30	< .01	1.65	> .30	.71	> .30
13	0.46	> .30	3.47	.20-.10	.70	> .30	.97	> .30	.71	> .30	.83	> .30
14	2.70	.30-.20	12.64	< .01	3.89	.20-.10	.83	> .30	.59	> .30	7.79	.05-.02[a]
15	7.05	.05-.02	5.82	.10-.05	12.80	< .01	1.53	> .30	2.24	> .30	.12	> .30
16	5.12	.10-.05	27.94	< .01	6.40	.05-.02	6.26	.05-.02	2.95	.30-.20	7.55	.05-.02[b]
17	14.68	< .01	8.98	.02-.01	15.44	< .01	1.11	> .30	0.30	> .30	.71	> .30
18	0.63	> .30	1.87	> .30	1.53	> .30	1.95	> .30	.83	> .30	4.37	.20-.10
19	1.19	> .30	2.36	> .30	.97	> .30	5.70	.10-.05	0.000	> .30	.47	> .30
20	8.84	.02-.01	10.91	< .01	1.95	> .30	3.76	.20-.10	5.04	.10-.05[b]	3.07	.30-.20
21	0.75	> .30	9.76	< .01	1.67	> .30	.97	> .30	.94	> .30	3.30	.20-.10
22	2.77	.30-.20	4.12	.20-.10	4.17	.20-.10	1.11	> .30	5.43	.10-.05	1.65	> .30
23									.59	> .30	1.53	> .30
24									.24	> .30	9.32	< .01[b]
25									.12	> .30	45.19	< .01[b]
26									1.89	> .30	29.97	< .01[b]
All Cases	7.71		7.71									

*Direction of prediction such that high scores are associated with High nomination except as noted otherwise:
"a" denotes middle range scores associated with High nomination.
"b" denotes low range scores associated with High nomination.

tests this has not been done. However, in Table 6.14 are presented rank-specialty breakdowns for items 2, 5, 6, and 17, which represent the four circled items yielding chis-squared significant at below the .01 level. Although none of these four-fold contingency tables presented in Table 6.14 would yield chis-squared significant at below the .05 level, inspection indicates that in the case of both the Junior and Senior Single-engine samples, the direction of prediction, for all four items is the same, i.e., either the greatest incidence of high scores is among High nominees, or the greatest incidence of Low scores is among Low nominees.

Analysis of Data from the Complete Sample, Discussion and General Summary

Analysis of pooled data from the complete sample indicated statistically significant relationships between test score and High and Low nomination *per se* for the MCT, PT, and for the FAR, but none for the BI (training score key). However, for the three tests (the FAR representing a combination of MCT and BI scores) analysis in terms of rank-specialty sub-samples indicated that statistically significant contingency (at least below the .05 level) between test and nomination status was evident only for the MCT, and this for only three of the four sub-samples[6] thus suggesting that the evidence for predictive value on the basis of pooled data from the entire group is suspect.

One important implication of the analysis by rank specialty sub-samples was that for all tests there was evidence of difference in predictive efficiency, and indeed in direction of prediction, over the various sub-samples. These differences were least marked for the MCT, and most marked for the BI.

It should further be emphasized that whereas the contingency between MCT score and the criterion was of statistical significance, the differentiation of the criterion groups was not such as to be associated with practical predictive significance. Nevertheless, the evidence of possible predictive value is of certain general and theoretical interest.

With reference to prediction of reasons for nomination by the BI and the PT, neither of these instruments predicted the bulk of the reasons, as did the MCT. For the BI, prediction of a few reasons was indicated by the analysis of the pooled data which, however, were not substantiated in the analysis of data on certain of these items in terms of the rank-specialty breakdowns. However, a tendency was evident for High BI scores to be associated with Low nomination, and vice versa, although this situation might well have resulted from the influence of extraneous and uncontrolled factors.

Similarly for the PT, evidence of prediction of certain reasons for nomination, based on data from the group as a whole, was not substantiated in the analysis of data on certain of these items in terms of rank-specialty breakdowns.

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[6] The contingency for Senior-Officer Multi-engine pilots not being statistically significant. Significant contingencies were indicated for Single-engine Junior and Senior officers, and for Multi-engine Juniors.

TABLE 6.14

BREAKDOWN OF PT DISTRIBUTION BY RANK AND SPECIALTY FOR SELECTED CIRCLED ITEMS

Item / Sub Sple	Rank	2 High	2 Low	5 High	5 Low	6 High	6 Low	17 High	17 Low
S.E. Sr.	28-	24 (31)	8 (47)	35 (38)	14 (42)	11 (30)	12 (48)	21 (36)	22 (43)
	29+	54 (69)	9 (53)	57 ([illegible])	19 (58)	26 (70)	13 (52)	38 (64)	29 (57)
	Total	78	17	92	33	37	25	59	51
M.E. Sr.		Data Inadequate							
S.E. Jr.	28-	80 (52)	63 (58)	46 (46)	54 (53)	21 (41)	45 (56)	20 (49)	46 (36)
	29+	74 (48)	45 (42)	53 (54)	48 (47)	30 (59)	36 (44)	21 (51)	83 (64)
	Total	154	108	99	102	51	81	41	129
M.E. Jr.	28-	34 (62)	19 (61)	17 (63)	14 (58)	5 (38)	9 (60)	5 (38)	19 (51)
	29+	21 (38)	12 (39)	10 (37)	10 (42)	8 (62)	6 (40)	8 (62)	18 (49)
	Total	55	31	27	24	13	15	13	37

*Red figures denote percentages of High (or Low) nominees.

Again, although the results could not be considered conclusive because of the lack of control of extraneous factors, the evidence that among High and Low nominees respectively, placement in certain reason for nomination categories might be related to test score is of interest.

The results of all of these analyses are rendered extremely equivocal because of the uncontrolled influence of extraneous factors, particularly factors associated with rank. The findings, however, would seem to warrant consideration of additional and more adequately controlled analyses in terms of reason for nomination.

In this connection the results of the factor analysis have important implications. Collapsing of reason for nomination data in terms of the reason for nomination factors would make possible rank-specialty breakdowns containing sufficient number of cases to make more definitive analyses possible.[7]

Although the implications of these analyses are extremely equivocal in so far as experimental results are concerned, certain methodological implications are definitely unequivocal. The major consideration brought out by this research is the absolute necessity of dealing with homogeneous sub-samples in all investigations involving these combat criterion data due (1) to the fact that incidence of High or Low nomination is related to rank, and (2) to the fact that marked differences in the distribution of test scores are evident over rank and specialty sub-samples. This, in turn, may be due to differences in the bases of selection.

ANALYSIS OF DATA FROM TEN AIR GROUPS

The results of the analysis of data from the complete sample discussed in the first part of this chapter were, as just noted, extremely equivocal due to the lack of control of extraneous factors, particularly those associated with rank and specialty. Another limitation of the analyses discussed previously has been that only a part of the test data is utilized, i.e., only data on nominated pilots have been considered, and non-nominated pilots have been ignored.

In view of these facts it appeared desirable to subject a defined and limited portion of the data to intensive study, in order that more definitive conclusions might be drawn as to the efficiency of the three psychological tests in predicting the criterion. For this analysis subjects from 10 selected air-groups, all Single-engine pilots, were utilized.[8]

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[7]One possibility might be to assign each subject "factor scores" on the basis of the factor loadings of the reasons used in connection with his nomination for High or for Low. In this way a continuous distribution of both test and criterion variables could be obtained.

[8]Air groups 6, 9, 10, 17, 25, 30, 46, 47, 82, and 83. Reference has been made in other connections to analysis of data from these 10 air groups, in Chapters IV and V.

Nature of the Sample

The sample included 1311 pilots, drawn from the 10 air groups. A unique feature of this part of the investigation was that it included an analysis of the non-nominated as well as the nominated pilots within the specified air groups. Thus it was possible to determine the percentage of coverage secured by the nominating technique -- i.e., the percentage of pilots in each air group who were nominated.[9] The distribution of pilots throughout the 10 air groups is presented in Table 6.15.

Distribution over Two Rosters. It will be noted that this breakdown indicates the number of pilots (1) on the roster of each air group six months prior to the visit of the field investigators and (2) at the time of the visit of the field investigators, as well as (3) the number of pilots who appeared on both rosters and on either roster.[10] Reference back to Table 4.11 (Chapter IV) indicates that the definition of the sample appeared to make no substantial difference in the per cent of pilots nominated, or not nominated. Inspection of Table 4.11 in Chapter IV indicates that 52 per cent of the men appearing on either or both rosters were not nominated, as compared with 50 per cent of the men appearing on the first roster, and 50 per cent of the men appearing on the second roster. Therefore, in order to increase the size of the sample, the analysis of prediction data for these 10 air groups was based, in general, on that group of pilots appearing on either or both of the two rosters. As noted previously 1311 men were thus represented. However, test data on all of these men were not available.

Comparison of the 10 Air Groups Sample with the Total Sample

As noted above, in this analysis of the effectiveness of tests in predicting the combat criterion, based on data from the 10 air groups, an attempt was made to control a number of extraneous factors not controlled in analysis of data from the total sample. However, in order for the implications of this analysis to be meaningful it is necessary to demonstrate that the 10 air group sample is comparable to the total sample in important respects. If no important differences in the samples are evident, any divergence between the results of the 10 air group analysis, and the previous analysis involving the total sample, could reasonably be attributed to the more adequate control of extraneous factors in the analysis of data from the more limited sample.

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[9]The analysis of data from the 10 air groups was conducted by Lt. (jg) John B. Carroll. A complete report on this study is on file in the Aviation Psychology Branch, Division of Aviation Medicine, Bureau of Medicine and Surgery, United States Navy.

[10]The sample did not include pilots who may have appeared temporarily in rosters with dates between the two rosters considered here. Various studies conducted in the Aviation Psychology Branch have indicated that only a negligible number of cases would be omitted by this restriction.

TABLE 6.15

LIST OF AIR GROUPS STUDIED, NUMBER OF PILOTS ON TWO ROSTERS OF EACH AIR GROUP SIX MONTHS APART, AND DATE OF FIELD INVESTIGATORS' VISIT

Air Group No.	N* 1	2	Both	Total	Date of Visit
6	162	165	140	187	June 1945
9	132	157	113	176	April 1945
10	149	160	106	203	April 1945
17	126	148	102	172	April 1945
25	50	48	45	53	June 1945
30	33	38	25	46	May 1945
46	46	54	39	61	May 1945
47	52	54	44	62	June 1945
82	119	104	72	151	April 1945
83	160	166	126	200	June 1945
Total	1029	1094	812	1311	

*Columns indicate N's as follows:

1 - Number on roster six months prior to visit.
2 - Number on roster at time of visit.
Both - Number of pilots appearing on both rosters.
Total - Number of pilots appearing on either roster.

TABLE 6.16

DATA ON THE PERCENTAGE OF RECOVERY OF TEST SCORE INFORMATION IN THE NOMINATED AND NON-NOMINATED SECTIONS OF THE SAMPLE OF PILOTS IN TEN AIR GROUPS

	Nominated Cases			Non-Nominated Cases			Total		
	% Recovery		Total	% Recovery		Total	% Recovery		Total
Rank	PT	MCT	N	PT	MCT	N	PT	MCT	N
Ens.	86.5	93.5	184	87.1	95.4	388	86.9	94.7	572
Lt. (jg)	86.1	94.0	201	83.5	92.6	230	84.7	93.3	431
Lt.	68.7	66.7	207	64.4	65.0	60	67.8	66.3	267
Lt. Comdr. & Comdr.	0.0	28.9	38	0.0	0.0	3	0.0	26.8	41
ALL CASES	75.2	80.9	630	83.5	91.3	681	79.6	86.3	1311

Notes: (a) Test Score Information for Nominated Cases punched directly from cards assembled for original study of 4325 nominated cases.

(b) PT = Personal Test Score or equivalent of Aviation Classification Test Score (any form).

MCT = Mechanical Comprehension Test (any form).

Comparison with Respect to Per Cent Nominated and not Nominated. This comparison has already been made, as indicated in Table 4.13. As noted in Chapter IV (Page 83) the air group sample contained approximately the same percentage of High nominees (in comparison with all pilots nominated) but a disproportionately low number of Low, and a disproportionately large number of Mixed, nominees. As pointed out in Chapter IV, this may have resulted from the fact that the bulk of the High nominees in the air group sample were nominated by respondents within the air group in question.

The crucial question is whether the Lows included in this sample are representative of the Lows in the total sample. The breakdown in Table 4.13 does not offer a definitive answer to this question. The higher incidence of Mixed cases, and the fact that all nominees were actually on the roster within six months of the time the data were gathered might suggest that the Lows in the air group sample were "not as Low," i.e., were not as inferior combat pilots, as the Lows in the total sample. This, however, is only an inference, but will be considered later in connection with discussion of results of analyses of the air group sample.

Comparison with Respect to Recovery of Test Score Information. Comparison in terms of recovery of test score information were made only with respect to the PT (Personnel Test) and the MCT (Mechanical Comprehension Test).[11] This breakdown is presented in Table 6.16.

From inspection of Table 6.16 it may be concluded that there are only slight differences in the distributions of either PT or MCT scores for the nominated sample as compared with the non-nominated sample, particularly when rank is held constant. The somewhat higher incidence of data-recovery for non-nominated cases than for nominated cases in either the air group or total samples may be explained by the fact that the non-nominated cases in the air group sample may have included a somewhat larger proportion of recently trained pilots (i.e., pilots of lower rank who had but recently arrived in the combat pipe-line.) Test score data on these pilots would be more readily accessible. It will also be noted that little data were recovered for officer above the rank of Lieutenant.

Recovery of test score data from the complete sample is indicated in Table 6.17, below. It will be noted that the test-score recovery was some-

TABLE 6.17

RECOVERY OF TEST SCORE DATA AMONG
CLEAR CASES IN THE COMPLETE SAMPLE
(N: Total = 4103; Highs = 2274; Lows = 1829)

	Total Cases		Highs		Lows	
	N	%	N	%	N	%
MCT	2907	71	1513	67	1394	76
BI	3156	77	1684	74	1472	80
PT	2571	63	1391	61	1180	65

[11]The BI is not included in this comparison since this test was introduced as a selection instrument at a considerably later date than the PT and MCT.

what higher among the 10 air group cases than for the complete sample. It is doubtful, however, that this fact could vitiate conclusions drawn from the air group sample.[12] It might also be noted that recovery was better among Lows than among Highs, probably because Lows represented in general officers of lower rank, who tended to be younger men who, in turn, had been tested more recently and whose test score data were more readily recoverable.

<u>Comparison with Respect to Test Score Distributions; with Complete Sample</u>: Comparison with respect to test score distributions of the complete sample were made only with respect to the PT and MCT tests, and with respect to Junior officer (Lt. jg and below), since the incidence of test score recovery from the higher ranks was low. Furthermore, in the case of the PT, no scores were included for men who had taken the Aviation Classification Test.[13]

The results of the comparison are presented in Table 6.18, separate comparisons being made for High and Low nominees. That the distributions of scores from the "air group" and total sample do not differ significantly is indicated by the results of chi-square analysis, none of the associated p values being lower than .10, and three of the four being .30 or greater. It can be concluded that with respect to PT and MCT score distributions there is no significant difference between the cases included in the "air group" sample and in the total sample.

<u>Comparison with Respect to Test Score Distributions: with Sample of Training Passers</u>. It was considered desirable to compare the "air group" sample (both nominated and non-nominated cases) with samples of aviation training passers in order to see whether selective factors may have operated to eliminate low test scorers from the combat pipeline after graduation from training. It is difficult to obtain an adequate sample of training passers which would be comparable with the hypothetical population of training passers from which the present sample of men in ten air groups was drawn. A comparison has been made, however, with a sample of training passers all of whom entered Primary Flight Training in September and October 1942. These cases graduated, on the average, in March-April 1943, a period in which many of the present sample completed training.

The comparisons are presented in Table 6.19. The cases in the ten air groups have been broken down by rank to give a rough indication of the trends in test score distribution with varying dates of training completion. No chi-squared tests were made since it was doubted that any meaningful hypotheses can be set up for testing on the basis of the table. In the interpretation of the table, it must be held in mind that the majority of passers from the sample of September-October 1942 primary training entrants would be Lt. (jg)'s by the

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[12] Particularly since, in any event, recovery of test score data from the air group sample was <u>more</u> complete.

[13] However, in certain analyses to be discussed subsequently equivalent PT scores were inferred from ACT scores.

TABLE 6.12

COMPARISON OF TEST SCORE DISTRIBUTIONS:
(a) Nominated Cases in Ten Air Groups
(b) Complete Set of 4325 Nominees
(Ensigns and Lieut.(jg)'s only)

Note: The comparisons are made by a χ^2 test of the independence of the distributions of (A) the nominated cases in the ten air groups and (B) cases in the complete set of 4325 nominees which did not occur in the ten air groups. Thus, the frequencies under (A) and (B) total to the frequencies in the complete set of data.

Comparison of Personnel Test Distributions:

PT Score	HIGHS (A)	(B)	Total	LOWS (A)	(B)	Total
32-48	37	122	159	26	116	142
26-31	67	150	217	58	173	231
10-25	43	108	151	31	153	184
Total	147	380	527	115	442	557
χ^2	2.670	$P < .30$		χ^2 4.887		$P < .10$

Comparison of Mechanical Comprehension Test Distributions:

MCT Score	HIGHS (A)	(B)	Total	LOWS (A)	(B)	Total
56-71	66	178	244	39	146	185
50-55	71	163	234	61	207	268
30-49	51	128	179	50	184	234
Total	188	469	657	150	537	687
χ^2	0.625	$P > .70$		χ^2 0.216		$P = .90$

TABLE 6.19

COMPARISON OF TTCT SCORE DISTRIBUTIONS:
(a) All Cases in Ten Air Groups
(b) Training Passers from Sample Entering Primary Training in September and October 1942.

Comparison of PT Distributions

PT Scores	Training Passers from Sept.-Oct. '42 Primary Entrants N	%	Cases in Ten Air Groups: ENSIGN N	%	LT. (jg) N	%	LIEUT. N	%	All Cases Completing Training in first half 1943 N	%
32-48	511	30.6	63	19.0	88	24.4	69	38.3	26	30.9
26-31	721	43.2	160	48.2	158	43.8	76	42.2	33	39.3
10-25	436	26.1	109	32.8	115	31.9	35	19.4	25	29.8
Total	1668	100.0	332	100.0	361	100.0	180	100.0	84	100.0

Comparison of MCT Distributions

MCT Scores	Training Passers from Sept.-Oct. '42 Primary Entrants N	%	Cases in Ten Air Groups: ENSIGN N	%	LT. (jg) N	%	LIEUT. N	%	All Cases Completing Training in first half 1943 N	%
56-71	525	31.5	170	31.4	109	27.1	75	42.4	27	27.8
50-55	554	33.2	203	37.5	160	39.8	61	34.5	37	38.1
30-49	589	35.3	160	31.2	133	33.1	41	23.2	33	34.1
Total	1668	100.0	542	100.0	402	100.0	177	100.0	97	100.0

first half of 1945. Furthermore, it should be remembered that the cutting scores on the tests were gradually raised during the period covered by the training entrance dates of the air group sample.

If Table 6.19 is inspected with these facts in mind, there is no evidence that the air group sample differs with respect to test-score distribution from the hypothetical population of training passers from which it was drawn. Cases (in particular Lt. (jg)'s) in the air group sample completing training at approximately the same time as the comparison sample certainly do not differ significantly from that sample.

General Considerations. With respect to the comparability of the "air group" sample with the total sample it can be said, in summary, that the two samples were comparable in terms of test score distributions, although the "air group" sample did contain a disproportionately small number of Low nominees and was characterized by slightly more complete recovery of test score information. However, in view of the comparability in terms of test score distributions, and since no differences with respect to a sample of training passers were evident, the practical significance of the lack of comparability in incidence of Low nominees, and with respect to test score recovery, is lessened.

The Criterion

As noted previously, use merely of nomination in the High or Low group as the criterion measure of combat effectiveness was considered suspect, due to the relationship between such raw nominations and other possibly extraneous factors, particularly rank. Furthermore, use only of High and Low nominees resulted in disregarding data from a sizeable proportion of subjects who were not nominated. In view of these limitations of previous analyses, a criterion measure termed the "nomination score" was developed for use in the analysis of data from the "air group" sample.

The Unadjusted Nomination Score. The unadjusted nomination score was the square root of the absolute value represented by the difference between the number of High and Low nominations respectively received by any individual, i.e., $\sqrt{\text{Number High nominations - Number Low Nominations}}$. On this basis, the nomination score for a person nominated 17 times for the High group would be $+\sqrt{17}$ or + 4.1. The nomination score for a person nominated five times for the Low group would be $-\sqrt{5}$ or - 2.2. This same score would be given to an officer nominated once for the High group and six times for the Low group. Non-nominated officers in the air groups were assigned scores of zero.

The square-root of the difference between number of High and Low nominations was taken because of the fact that the distribution of the raw values was extremely leptokurtic. Although there was a considerable range of scores, most of them were concentrated between plus and minus one. Use of the square root rendered the distribution more normal.

In addition, the scale was translated into one with an arbitrary origin of 6, to eliminate the negative values. The distributions of unadjusted nomination scores, by rank and date of completing training, are presented in Table 6.20. All pilots for whom test data were not located have been excluded from this table, as well as officers with rank above Lieutenant, since test data recovery for such men was extremely meager. Examination of Table 6.20 indicates that the mean unadjusted nomination scores vary in terms of rank and date of completing training, and that the spread of these scores is markedly less for Ensigns than for Lieutenants.

<u>The Adjusted Nomination Score</u>. Because of the evident difference in these distributions in terms of rank and date of training completion, and because of the relationship evident between nomination for High and Low and these variables, an <u>adjusted nomination score</u> was derived. In the development of this score the distributions of unadjusted scores were converted, for each rank and period of completing training, into T scores. These distributions of T scores, presumably with equal means and standard deviations, represented nomination scores adjusted in terms of (or corrected for) rank and period of completing training. These scores are then measures of combat effectiveness which could be expected to be relatively unrelated to rank and period of training completion. The table for converting unadjusted to adjusted scores is presented in Table 6.21.

<u>Considerations Dictating Use of Adjusted Scores</u>. The necessity of employing an adjusted nomination score was indicated by the relationships evident among rank, date of completing training, and unadjusted nomination score. On the basis of 1275 cases from the 10 air groups (including officers for whom test score data were not available but for whom date of completing training could be located) the interrelationships among these variables were as follows:

Date completion vs. Rank	.825
Date Completion vs. Unadjusted Nomination Score	.263
Rank vs. Unadjusted Nomination Score	.283.

The multiple correlation for the prediction of the nomination score from rank and date of training completion was .288, with Beta coefficients of .207 and .092 respectively. Rank contributes the major share of the predictable variance in the nomination score.

The "adjusted nomination score" as derived from Table 6.21, has several characteristics which should be mentioned. First, it is virtually unrelated to the rank and experience of the nominee and thus presumably provides an unbiased measure of combat performance which can be applied equally to men of various ranks and amounts of experience.[14]

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[14] As mentioned in regard to the discussion of Table 6.23, following, the correlation between rank and the adjusted nomination score was .021.

TABLE 6.20

DISTRIBUTIONS OF NOMINATION SCORE (UNADJUSTED)
BY RANK AND DATE OF TRAINING COMPLETION

Limits of Intervals N_H N_L	RANK: Period of Training Completion: Nomination Score	LIEUT. 7/40-3/42	4/42-9/42	10/42-6/44	7/40-6/43	LT.(jg) 7/43-9/43	10/43-6/44	ENSIGN 1/43-12/43	1/44-3/44	4/44-6/44	7/44-12/44
17,25	11	1									
10,16	10	3	2	4	1						
5, 9	9	11	7	15	6	1	1				
2, 4	8	17	11	25	26	8	12	2	6	3	1
1	7	13	13	18	24	14	34	1	22	34	8
0	6	19	15	29	52	49	131	43	109	181	60
-1	5	9	8	4	7	4	15	5	16	22	8
-2,-4	4	7	7	6	5	11	8	3	8	19	2
-5,-9	3	3	1	6	2	5	5	1	2	6	1
-10,-16	2	1						2	1	2	
-17,-25	1		1	1	1						
	N	84	65	108	124	92	206	57	164	267	80
	Mean	6.73	6.52	6.83	6.56	5.91	6.07	5.70	5.95	5.83	5.93
	S. D.	1.85	1.77	1.80	1.36	1.26	0.94	1.04	0.88	0.91	0.68

TABLE 5.23

CONVERSION TABLE FOR UNADJUSTED AND ADJUSTED NOMINATION SCORES, VALUES IN THE CELLS OF THE TABLE ARE ADJUSTED NOMINATION SCORES IN THE FORM OF T-SCORES

Limits of Intervals N - N	RANK: Period of Training Completion: Nomination Score	LIEUT. 7/40-3/42	4/42-9/42	10/43-5/44	LT.(jg) 7/40-6/43	7/43-9/43	10/43-6/44	ENSIGN 1/43-12/43	1/44-3/44	4/44-6/44	7/44-12/44
17,25	11	73	75	73	83	90					
10,16	10	68	70	68	75	82	92	91	96	96	
5, 9	9	62	64	[illegible]	[illegible]	74	81	82	85	85	95
2, 4	8	57	58	56	61	67	71	72	73	74	81
1	7	51	53	[illegible]	53	59	60	62	62	63	66
0	6	46	47	45	44	51	49	53	51	52	51
-1	5	41	41	40	39	43	39	43	39	41	36
-2,-4	4	35	36	34	31	35	28	34	28	30	22
-5,-9	3	30	30	29	24	27	17	24	17	19	7
-10,-16	2	24	24	23	16	19	7	14	5	8	
-17,-25	1	19	19	18	9	11		5			

Secondly, a nomination of a pilot in the lower ranks has relatively greater weight than a nomination of a higher-ranking pilot. Thus, an Ensign who receives 5 nominations for the Low group may receive an adjusted nomination score of 7 to 24 whereas a Lieutenant (senior grade) receiving a similar number of nominations is assigned an adjusted nomination score of 29 or 30, depending on his date of training completion. Such a relation seems to make sense: an Ensign with 5 low nominations, having had relatively less opportunity to demonstrate his performance, would appear to be a much poorer pilot than a Lieutenant with only 5 low nominations.

Finally, it will be noted that the adjusted nomination scores assigned to non-nominated cases (with a nomination score of 6) vary from 45 to 53. As a result, non-nominated Ensigns are given the "benefit of the doubt," while higher ranking officers with more experience who still do not draw any nominations are assigned adjusted nomination scores somewhat more towards the low end of the scale.

In terms of this rationale, the adjusted nomination score to a degree corrects for an officers "exposure" and opportunity to prove himself (or for the lack of such opportunity) but does not in general correct for experience, per se. That is, it is assumed that if an Ensign performed inadequately under combat conditions, additional experience probably would not alter his basic behavior patterns.[15] Thus an Ensign with an unadjusted nomination score of 3 obtains actually a lower adjusted nomination score than a Lieutenant who also obtained an unadjusted score of 3.

Variability of Nomination Scores. Distributions of nomination scores by air groups are presented in Table 6.22. Analysis of variance indicated that there is no significant variability in the mean nomination scores of the various air groups. A similar lack of variability for adjusted nomination scores can reasonably be assumed.

Reliability of the Criterion. It appears impossible to compute an index of the reliability of the criterion in terms of a value comparable to the correlation coefficient. This results from the fact that no data are available bearing on the population of potential nominees considered by each respondent. Nor are there any data on the number of respondents who may have considered each nominee. Nevertheless, from the general characteristics of the results it can be seen that the nomination technique yields evaluations of behavior which are far from chance expectancy. As was the situation with respect to the complete sample, the number of Mixed cases is small in relation to the number of clear High and Low cases, (see Table 4.13). Moreover, the concentration of nominations on certain individuals is intense. Some of the individuals in the ten air groups studied received as many as 10 or more nominations for either the High or Low groups. Mixed cases who received many nominations were usually nominated for one or the other group by a large majority of the respondents, with only one or two dissenters.

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[15] Otherwise, an Ensign, having less experience and opportunity to improve might be assigned a relatively higher adjusted score than a Lieutenant with the same unadjusted nomination score.

TABLE 6.22

DISTRIBUTIONS OF NOMINATION SCORES BY AIR GROUPS (ALL CASES OCCURRING ON THE ROSTER AT TIME OF FIELD INVESTIGATOR'S VISIT)

AIR GROUP

Nomination Score	6	9	10	17	25	33	46	47	82	83	Total
11	2	1		1				1			5
10	2		2	4			1			3	12
9	8	5	8	6	2	2	1	4	4	10	50
8	8	13	18	16	6	9	5	4	15	19	113
7	21	14	32	31	5	7	8	8	16	32	173
6	97	105	75	56	26	16	32	30	52	78	567
5	10	8	15	11	4		3	3	11	11	76
4	12	8	6	17	4	3	2	3	4	5	64
3	5	3	3	4		1	2	1	2	7	28
2			1	2						1	4
1					1					1	2
N	165	157	160	148	48	38	54	54	104	166	1094
Mean	6.18	6.17	6.38	6.25	6.12	6.57	6.22	6.39	6.12	6.36	6.28
S.D.	1.36	1.12	1.29	1.59	1.38	1.35	1.21	1.37	1.19	1.47	1.35

Analysis of Variance

	S.S.	d.f.	Mean Square
Among Groups	11.61	9	1.29
Within Groups	1991.68	1084	1.84
Total	2003.29	1093	1.83

F = .701 (Not significant at .05 level)

In the discussion of the reliability of the nominating technique in Chapter IV, with particular reference to the total sample of cases, reference was made to an analysis conducted on the "air group" sample. In this analysis respondents from one air group were split into two sub-samples, and the nomination of each sample compared. Although certain inadequacies were noted, an estimate of reliability for the nominations of the order of .80 was made. As noted in Chapter IV, very similar results were obtained when raw nomination scores (number of High nominations minus number of Low nominations) obtained from two groups of respondents were correlated. The coefficient was .686, corrected by the Spearman-Brown prophecy formula to .814.[16]

Reliability of Adjusted Score. There has been no direct determination of the reliability of the adjusted nomination score. There is little reason to believe, however, that the adjusted score would be markedly less reliable than the raw or unadjusted nomination score. The adjusted score is a function of unadjusted score, rank, and period of completing training. These latter two variables are, however, matters of record, and as such are in a strict sense subject to very little unreliability.

Validity of the Criterion. No clear cut objective evidence is available as to the validity of the criterion, either with respect to the nomination scores, or with respect to the nominations for High and Low on which they were based. This subject will be considered in greater detail in the last chapter of this report. Suffice it to note, at this point, that the assumption basic to use of the nominating technique is that men actually engaged in combat aviation are the best judges of the total job effectiveness of their fellows.

Prediction of the Criterion Measures

Preliminary Analysis. In order to gain insight into the interplay of the various variables, many of which were not considered specifically in the analysis of test data based on the complete sample and discussed in the first part of this chapter, a number of crude preliminary analyses were made by means of the chi-squared technique. The most suggestive findings resulting from these analyses[17] were as follows:

(a) Holding rank constant, it was found that the better educated pilots were more likely to receive High nominations than those with less education.

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[16]Use of the Spearman-Brown formula in this connection is discussed in footnote 13, page 87, Chapter IV.

[17]These analyses, conducted in the Aviation Psychology Branch, will not be presented in detail, since they were based on incomplete data, and were subject to other limitations.

(b) Without regard to nominations the men differed significantly in test score distribution with respect to rank. The higher ranking officers had higher average test scores on the PT and MCT, but lower average test scores on the BI.

(c) With education held constant, the subjects of different ranks did not differ significantly in test score distribution.

(d) With rank and education held constant, the HIGHS and LOWS and NON-NOMINATED cases did not differ significantly on the MCT.

(e) With neither rank nor education held constant, the HIGHS and LOWS and NON-NOMINATED cases differed significantly in MCT test score distributions, but not significantly on the PT.[18]

The implications of this analysis indicated the advisability not only of using the adjusted nomination score in studies of the predictive value of the tests, but also of taking into account the variables Educational Status and Age. Information on educational status was obtained from item 27 on the Biographical Inventory; on age from Navy records.

Variables Considered in Prediction Analyses. When all cases had been reviewed it was found that 954 cases were complete with the following information:

Rank
Unadjusted nomination score (on scale from 1 to 11)
Adjusted nomination score (T-score)
Age
Education
Personnel Test or PT equivalent of ACT score
MCT
BI
FAR

Restrictions on Sample. It will be noted that these 954 cases from the 10 air groups under investigation did not include any Lieut. Commanders or Commanders, since adjusted nomination scores were assigned only to the lower ranks inasmuch as recovery of test data for the higher ranks was negligible.

Prediction of Nomination Score. Intercorrelations among the variables listed above are presented in Table 6.23. It will be observed from inspection of columns 7 and 8 in this table that the correlations between test measures and the adjusted scores are lower, throughout, than are the correlations with the unadjusted score. However, with reference to test measures,

[18] Insofar as they correspond, these findings are generally in line with the chi-squared analyses in terms of data for the complete sample, discussed in the first part of this chapter, except that some predictive significance was evident for the PT when rank and specialty was not held constant.

TABLE 6.23

CORRELATIONS AMONG SEVERAL PREDICTOR VARIABLES, CRITERION VARIABLES, AND RANK
NOMINATED AND NON-NOMINATED CASES IN TEN AIR GROUPS WITH COMPLETE DATA
N = 954

	Predictor Variables						Criterion		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Age	Educ.	PT	MCT	BI	FAR	(Unbiased) Adj. Nom. Score	(Biased) Unadj. Nom. Score	Rank
1. Age	-	.396	.038	.049	-.116	-.065	.040	.194	.502
2. Education	.396	-	.263	.134	-.012	.064	.046	.164	.370
3. PT(ACT)	.038	.263	-	.284	.044	.177	.013	.020	.048
4. MCT	.049	.134	.284	-	.154	.667	.053	.078	.064
5. BI	-.116	-.012	.044	.154	-	.713	-.043	-.080	-.055
6. FAR	-.065	.064	.177	.667	.713	-	.003	-.012	.003
7. Adj. Nom. Score	.040	.046	.013	.053	-.043	.003	-	.917	.021
8. Unadj. Nom. Score	.194	.164	.020	.078	-.080	-.012	.917	-	.274
9. Rank	.502	.370	.048	.064	-.055	.003	.021	.274	-

$\sigma_r = .032$ $\quad r_{p\,=\,.05} = .063$ $\quad r_{p\,=\,.01} = .082$

Multiple Correlations:

$R_{7:12345} = .085$ $(P > .05)$

$R_{8.12345} = .239$ $(P < .01)$

the correlations with even the unadjusted score are hardly large enough to be of practical significance, and in fact, only the coefficients for the MCT and BI (with the unadjusted score) could be considered to approach statistical significance at the .01 level. In this connection the negative correlation between BI and unadjusted score is in line with the findings based on analysis of data from the complete sample. On the other hand none of the correlations with the adjusted score are significant at even the .05 level.

It is noteworthy that Rank correlates relatively high with the unadjusted score (.274) but practically zero (.021) with the adjusted score, indicating that the effect of rank has been adequately controlled. Similarly age and education correlate markedly higher with unadjusted than with adjusted score. This reduction in the coefficients can of course be explained in terms of the relatively high correlation of age and education, respectively, with rank.

Multiple Correlations. The multiple correlation of the test variables plus age and education also are presented in Table 6.23. It is of interest that the multiple coefficient involving the unadjusted score is relatively high (.239) and statistically significant, whereas the coefficient involving the adjusted score is markedly lower (.085) and is not statistically significant. This difference can be explained in large part by the fact that age and education bore the major burden of prediction of the unadjusted score, but that the effect of these variables was markedly reduced in the prediction of the adjusted score through their correlation with rank, the effect of which was eliminated as a contributor to the variance of adjusted scores.[19]

Correlation with Composite Physical Training Grade. For 189 of the 934 cases studied above, data were also available on one other possible predictor of combat performance. This was a composite physical training grade which had been assigned to the men when cadets at Pre-Flight School. The correlations of the composite physical training grade with other predictors and with the criteria are as follows:

	Composite Physical Training Grade (N-189)
Adjusted Nomination Score	.102
Unadjusted " "	.116

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[19] The relationship of age and education, respectively, with rank and with the unadjusted scores may be explained in part by the fact that the higher ranking, older men draw more nominations for the high group than do the younger officers, and partly by the fact that the higher ranking officers not only tend to be older but to have more education, on the average, than do the younger officers. In April, 1942, the standards for admission of Aviation Cadets were changed to permit civilians with less than two years of college to enter the program. The higher ranking officers were selected, in general, before this lowering of the standards occurred. It is not surprising, therefore, that education should appear to be a significant predictor of combat acceptability when a criterion biased in favor of the higher ranks is used.

Rank	-.142
Age	.017
Education	-.057
PT (ACT)	-.147
MCT	-.092
BI	-.055
FAR	-.060

It is of interest to note that in this group of cases, the test predictors made an even poorer showing than in the total group. The validity coefficients (with the adjusted nomination score) were as follows:

	(N=189)
Age	.051
Education	.084
PT (ACT)	.055
MCT	-.013
BI	-.106
FAR	-.075

These coefficients are of doubtful significance because of the small number of cases. Since the non-nominated cases were not included, the coefficients are if anything larger than they would have been had all cases been included.

While none of these coefficients is statistically significant, it is of some interest to note that on the basis of the limited data available, the composite physical training grade appears to predict the unadjusted criterion slightly better than did any of the test measures, although the relationship is so low as to be of little practical importance.

Comparison with Prediction of Success in Flight Training. It is enlightening to compare the predictive efficiency of the tests in predicting the combat criterion with their efficiency in predicting success in training. First, it should be noted that the intercorrelations among the PT, BI, and MCT, obtained on the air group sample were in general comparable to the intercorrelations obtained on samples used in determining the efficiency of the tests in predicting training criteria. Fiske states "typical" correlations between the PT and MCT were .30, between the PT and BI, .05, and between the MCT and the BI, .25.[20] Reference to Table 6.23 indicates that the only marked difference from these general figures arises in the case of the correlation between MCT and BI, which was .15 as compared to about .25 on Fiske's samples.

The correlation between test measures and various reasons for failure in flight training, on three samples, is presented in Table 6.24. A combination of the BI and MCT yielded a multiple correlation of .41 for each

[20]Fiske, Donald W., Validation of naval aviation cadet selection tests against training criteria, Jl. of Appl. Psychol., 31, 6, December 1947, pp. 601-614.

TABLE 6.24

PREDICTION OF THE TRAINING CRITERION BY THE PT, MCT AND BI

Personnel Test: Criterion Correlations for Failure Groups**

Sample	N	Flight Failures r	Flight Failures N	Ground School Failures r	Ground School Failures N	Dropped at Own Request r	Dropped at Own Request N	All Other Failures* r	All Other Failures* N	All Failures r	All Failures N
A	2356	.12	(452)	.31	(45)	.04	(56)	.14	(42)	.17	(595)
B	1818	.08	(295)	.20	(24)	-.04	(56)	.14	(72)	.11	(447)
C	2073	.08	(228)	---	(13)	.07	(76)	.01	(101)	.08	(405)

Mechanical Comprehension Test: Biserial Criterion Correlations for Failure Groups

Sample	N	Flight Failures r	Flight Failures N	Ground School Failures r	Ground School Failures N	Dropped at Own Request r	Dropped at Own Request N	All Other Failures* r	All Other Failures* N	All Failures r	All Failures N
A	2356	.33	(452)	.25	(45)	.11	(56)	.11	(42)	.35	(595)
B	1818	.27	(295)	.32	(24)	.16	(56)	.14	(72)	.32	(447)
C	2073	.29	(228)	---	(13)	.10	(76)	.12	(101)	.27	(405)

Biographical Inventory: Biserial Criterion Correlations for Failure Groups

Sample	N	Flight Failures r	Flight Failures N	Ground School Failures r	Ground School Failures N	Dropped at Own Request r	Dropped at Own Request N	All Other Failures* r	All Other Failures* N	All Failures r	All Failures N
A	2356	.29	(452)	.06	(45)	.18	(56)	.04	(42)	.30	(595)
B	1818	.34	(295)	.09	(24)	.14	(56)	.11	(72)	.33	(447)
C	2073	.34	(228)	---	(13)	.09	(76)	.23	(101)	.35	(405)

*Each coefficient is a biserial r comparing the designated failure group with all other entrants (passers plus any failers not in the designated group).

**All failures except those groups for which correlations are cited.

of the three samples.[21] It will be noted that these coefficients are very much higher than are the coefficients indicative of relationship between the tests and the combat criterion. The PT was least effective in regard to flight measures, but served to predict ground school grades rather well. It can be said that the battery predicted flight training measures (for which function it was designed) much better than it predicted even a biased measure of combat proficiency.

General Considerations. In general it can be said, then, that the test measures did not predict either the biased unadjusted nomination score, or the unbiased adjusted nomination score, to a degree associated with practical predictive efficiency, although with reference to the unadjusted score two of the coefficients (for the BI and MCT) approached the level of statistical significance (the coefficients being about .08). Rank was, however, related to the unadjusted nomination score (.274), but not to the unbiased adjusted score (.021), thus indicating that in terms of the adjusted score the influence of rank as an extraneous variable was well controlled. The relatively higher correlations between Age and Education, respectively, with unadjusted score are probably due in large part to their relatively high correlation with rank.

Evaluation of Nomination Score

Advantages. Use of the nomination score has a number of advantages. For one thing, the criterion variables are continuous, it being assumed that other things being equal a pilot drawing 10 nominations for High is more desired (and is therefore a more effective combat pilot) than an officer drawing only five nominations. Furthermore, with reference to "other things being equal" the adjusted nomination score is unbiased with respect to rank and experience, and indirectly, at least in the air group sample, relatively unbiased with respect to age and education. In addition, use of the nomination score makes it possible to take more complete advantage of the data in that non-nominated pilots can also be assigned scores, with an appropriate adjustment for the effects of rank on nomination status. On these grounds it would seem advisable to emphasize the use of an unbiased nomination score as the most desirable criterion for test validation.

Disadvantages: "overadjustment." A critic might argue that in the process of adjusting the nomination scores to be unbiased with respect to rank and experience the "baby has been thrown out with the bathwater," i.e., that a significant amount of predictable variance in the criterion has been "washed out." It should be noted, however, that use of an adjusted, and thus unbiased, score is very similar to partialling out the effect of rank and experience by partial correlation techniques. When rank is held constant the partial correlation coefficients between the predictor variables and the unadjusted nomination score are as follows:

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[21] Ibid.

	Partial Correlation with Unadjusted Nomination Score
Age	.067
Education	.070
PT	.007
MCT	.063
BI	-.068
FAR	-.014

These coefficients are only slightly higher on the whole than the zero-order validity coefficients with the <u>adjusted</u> nomination score. They would perhaps be further reduced if the date of training completion were also partialled out.[22] This partial correlation procedure however might also be considered to "wash out" a significant amount of predictable variance in the criterion since holding rank constant might, on some grounds, be considered unrealistic.

<u>Disadvantages: the Assumption of a Continuum</u>: Question might be raised to the assumption of a continuum of "Highness" and "Lowness" with non-nominated officers occupying a position in the middle of the scale. Three objections might be raised: first that the procedure of subtracting the number of Low from the number of High nominations is unsound; second that the assumption is not tenable that number of nominations given an officer is a measure of his acceptance or combat efficiency (i.e., that a man nominated 5 times for High is better than one nominated 3 times); and third, that assigning essentially neutral weights for non-nomination is not justified.

<u>Consideration of Objections</u>: The first of these objections is not of great consequence since relatively few nominees received nominations both for High and Low, and in most of these cases there was a marked plurality one way or the other. Therefore the question of whether an officer who receives 10 nominations for High and 1 for Low can be considered generally matched in terms of acceptance (and in this respect in terms of combat efficiency) with one who receives 9 nominations for High and <u>none</u> for Low may be of not much more than academic interest.

The last two objections would seem to revolve around the question of other factors (extraneous to the primary consideration of acceptance as a combat effective, or lack of it) which might have influenced the number of nominations received, or the failure to be nominated at all. One major extraneous factor might be "amount of exposure," i.e., the length of an officer's tour in combat areas. Thus, of two officers equivalent in terms of acceptance as combat effectives, one might have been in the combat areas for a long period of time, be known to more of his fellows, and thus receive more nominations than the other whose tour may have been less extended, and who thus received fewer nominations, or if a recent arrival perhaps none at all.

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[22] This was not done because the relationship with date of training completion do not seem to be linear.

The influence of this extraneous factor obviously represents a limitation in the use of the nomination score. However, in so far as "amount of exposure" is a function of rank and date of completing training, the influence of this extraneous factor is largely controlled and eliminated through use of the **adjusted** nomination score, as noted previously. Nothing definitive can be said, however, with reference to the influence of factors other than rank and date of completing training on "amount of exposure," although certain inferences can be drawn from the results of analyses discussed in Chapter IV.

Reference to an analysis based on a sample of 3303 carrier and Multi-engine pilots, discussed in Chapter IV, indicates that among Highs there was a relationship between rank and incidence of multiple nominations, but that this relationship was not evident among cases nominated for Low. This might have resulted from the fact that the attrition among "Low" Senior officers was greater than among Highs, due to these officers being relieved of combat duty, or for other reasons, such as death. On the other hand the "Low" Senior officers may have included a greater number of recent arrivals in the combat areas.

In terms of either of these alternatives, it cannot be said that control in terms of rank and time of completing training (as was accomplished by the adjusted nomination score) represented adequate control of the effect of "amount of exposure" on number of nominations received. It would seem, therefore, that at least with respect to Low nominees, some question might be raised with respect to use of the number of nominations as an index of "Lowness." The seriousness of this limitation cannot readily be evaluated, although it will be considered in subsequent discussion.

Disadvantages: Failure to Consider Reason for Nomination. Another objection to the use of the nomination score in analysis of data from the air group sample is that reason for nomination was not considered. In view of the relatively low correlations between reasons for nominations (considered in the next chapter) it would not be impossible that somewhat higher coefficients could be obtained if the "validity" of the tests were determined through use of criterion groups composed of subjects nominated for High and Low for specific reasons. It will be recalled that in the analysis of data from the complete sample some suggestion was evident that reasons for nomination could be predicted even when no relationship between test score and nomination status irrespective of reason was evident. This too represents something of a limitation of the analysis of data from the air group sample, the seriousness of which cannot directly be evaluated, although there is no reason why an adaptation of the nomination score could not be made in terms of reason for nomination.

Nomination Score: General Evaluation. It would seem that the most compelling and indeed perhaps the only critical objection[23] to the nomination score is that it may not adequately correct for "exposure," i.e., that the

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[23]Since the nomination score technique could probably be adapted to data in terms of "reason for nomination."

number of nominations may be a function of other and extraneous factors unrelated to rank and date of completing training which influence an officer's "exposure" to his mates, and thus the number of nominations he receives. If this objection is tenable, the number of nominations might not be a valid measure of the relative "Highness" or "Lowness" of the officer in question.

The legitimacy of this objection cannot be determined experimentally. However, it was noted that among High nominees, number of nominations was a function of rank, although among Low nominees there was little relation between rank and number of nominations.[24] This situation could be explained by a number of factors, for example the fact that Low senior officers may have included a greater number of recent arrivals in the combat areas, with relatively little combat experience, who received Low nominations. Therefore, the adjustment of nomination scores for rank, among Low nominees, may have represented a qualitatively different sort of correction than was the case for High nominees, where rank was related both to tendency to be nominated for High, and to number of nominations. Thus a reasonable objection might be that with respect to Low nominees, the adjusted nomination score in some cases represented an overcorrection for the effect of rank and that in general number of nominations may be so influenced by extraneous factors that the figure represents a questionable measure of relative "Highness" or "Lowness."

This objection, it should be emphasized, does not vitiate the work done on the air group sample through use of the nomination score. The major implication of this research is that correction for rank and other variables decreases the apparent test-criterion relationships. Since none of the coefficients, even those involving unadjusted nomination scores, indicate predictive significance of a degree associated with practical value, the fact that the adjustment introduced a possible over-correction or that number of nominations may not be a valid index relative of "Highness" or "Lowness" is of little immediate significance. Furthermore, one must consider whether the advantages of the nomination score, e.g., continuity of distribution and utilization of all the data, may not outweigh its possible limitations. However, in future work, it might be advisable to obtain homogeneous samples of sufficient size to render analysis meaningful without recourse to statistical correction for the effect of extraneous variables.

Comparison of Results of Analysis of Air Group Sample and Total Sample

With reference to the analysis of prediction of High or Low nomination, irrespective of reason, the analysis of the air group sample is in general agreement with the results of the analysis from the sample as a whole.[25]

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[24]Also, as noted in Chapter IV, on the basis of the air group sample the incidence of Low nominations was relatively comparable from rank to rank, although among High nominees, senior officers received a disproportionate number of (High) nominations.

[25]Since analysis by reason for nomination was not made on the air group sample comparison in this term cannot, of course, be made.

In terms of both analyses, the importance of controlling factors associated with rank were evident. Although in neither analysis was prediction of a degree associated with practical significance evident, one lack of agreement might be noted. In the analysis of data from the complete sample statistically significant contingency between MCT score and nomination status was evident, even in samples relatively homogeneous in terms of rank and specialty. However in terms of adjusted nomination score data, no significant relationship between the MCT and the criterion was evident. This may have resulted from more adequate control of extraneous factors, from inclusion of non-nominated pilots in the air group sample, or possibly from limitations in the nomination score which attenuated the coefficient.

The air group sample analysis confirmed one trend evident in the analysis of data from the complete sample. In this analysis, it will be recalled, a trend was evident which suggested that High BI scores were associated with Low nomination, and more particularly with certain reasons for Low nomination, although in general the trend was far from being statistically significant. In the air group sample analysis it is of interest to note that the correlation between the BI score and the criterion was extremely low, but negative.

Summary Consideration of Results of Prediction Research

These analyses involving test score data render one point unequivocal. The test battery which functioned to predict success in training does not predict this combat criterion.

It should be recognized, of course, that one of the factors limiting the apparent relationship between selection tests and criteria of combat effectiveness may have been the restriction in range of the test scores which resulted from the fact that the sample had in general previously been selected in terms of the test scores. In other words, only pilots obtaining test scores higher than a given critical level for admission to flight training were included in the combat criterion samples. This restriction in range is, however, unavoidable since success in training is a necessary prerequisite to operational flying, and any battery devised for prediction of combat effectiveness must necessarily also predict ability to succeed in flight training.

In terms of these facts the most obvious development would seem to be the re-evaluation of present tests in terms of criteria of combat effectiveness, or the development of new tests to predict this criterion. Since on the present sample test score data on only the PT, MCT, and BI were available, validation of other tests, utilizing the present sample, was impossible. Furthermore, re-evaluation of the PT and MCT did not appear particularly promising, since individual items on these tests were in general either "right" or "wrong."[26] For this reason, in developmental work on "Combat

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[26] It would be possible, of course, that in terms of these tests a curvilinear relationship with combat effectiveness might prevail. Some suggestion of non-linearity was evident from the analysis of data from the entire

Keys," attention was centered on the Biographical Inventory. It also appeared, on rational grounds, that this test would offer the best possibility of predicting the combat criterion.

DEVELOPMENT OF "COMBAT KEYS" FOR THE BIOGRAPHICAL INVENTORY

It is evident, then, that even in terms of possibly biased combat criterion measures, test-criterion relationships were not of a magnitude associated with practical predictive significance, and were markedly lower than were the relationships between the tests and criteria of success in flight training. This, of course, was to be expected since the tests were originally designed and validated against training criteria. There would be little reason to expect, among a relatively homogeneous group of subjects who had not been eliminated during a rigorous training course, that a high relationship between flying ability as evidenced in training, and proficiency in combat would be evident.

Early Investigations

Initial attempts in the development of "Combat Keys" for the BI were directed toward obtaining keys that would differentiate Highs and Lows in specific categories. After four analyses (in terms of free-response categories 1, 4, 5, and 100) this approach was abandoned. Cross-validation of keys failed to hold up. The most successful analysis was with reference to category 100, where the cross-validation produced a chi-square with a probability value of .02. However, the differences in the distributions were almost entirely among the high scores, and little differentiation among the low scores was indicated.

The next step was an attempt to construct a key that would differentiate the Highs from the Lows regardless of category. 189 High answer sheets and 243 Low answer sheets were available for the item analysis and a like number for the cross-validation. The first key constructed, by selecting items significant at the 7% level or better, yielded a cross-validation chi-square of .01. However, here again, the differences obtained were almost entirely in the upper range of scores -- the key did not differentiate to any appreciable extent in the low range.

For a second key, only items were used which had a probability of .01 or better as shown by the item analysis. This key obviously had considerably fewer items than the first key. The results were very similar to those obtained by application of the first key, i.e., significant chi-square with most of the difference accountable for in the high range of scores.

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26 (Cont.) sample, although the trend evident in some cases was not sufficiently pronounced to indicate the necessity of more exhaustive exploration of this problem.

It was evident that a relatively large number of items showing significant differences on the validation sample were not holding up on the cross-validation sample. Therefore item analyses were made utilizing the two independent samples and a key was constructed by combining the probability values and using as a criterion of acceptability a p value of .05 where the direction of the difference was the same on both samples. This key contained 56 positively weighted and 62 negatively weighted items, and was in turn cross-validated on 108 Highs and 129 Lows, who represented new nominations recently forwarded from the field investigators. Analysis of data from this cross-validation sample indicated a significant difference between means scores of Highs and Lows, and yielded a biserial correlation of .29.[27]

The possibility was evident, however, that the apparent relationship was inflated due to the effect of possible age differences between Highs and Lows. An item analysis was therefore run on High and Low samples, each numbering 172, equalized for age. The resulting key contained 36 positively weighted and 41 negatively weighted items. This key, when cross-validated on 95 Highs and 95 Lows, equalized for age, showed poor discrimination between Highs and Lows. Actually, the results were similar to those obtained on the first two analyses. Some differentiation was evident, but chiefly among scorers in the upper range. In addition, a marked indication of greater variability among Highs than among Lows was present.

However, a fifth key was constructed by merging the promising items from the original analysis, the original cross validation analysis, and the age equalization analysis. The resulting key contained 68 positively weighted and 70 negatively weighted responses. When cross-validated on 108 Highs and 129 Lows a biserial coefficient of .26 resulted. It is of interest that while these subjects were not equalized in terms of rank, they were equalized in terms of age, which in the air group sample correlated relatively high (.50) with rank. (See Table 6.23).

Although some evidence of predictive value was suggested by this coefficient obtained on a relatively small group, additional analysis indicated marked differences in the distributions of scores between carrier and patrol boat pilots. Analysis of data from 57 High and 58 Low CV pilots, and 42 High and 48 Low P-boat pilots suggested that on the whole P-boat pilots scored higher than did CV pilots, the distribution of scores for Low P-boat pilots on one key being almost identical with the distribution of scores for High CV pilots.[28]

In addition to indicating the necessity of further control in the analysis

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[27] This coefficient, however, was not corrected for widespread categories.

[28] It was recognized that the failure of many items to hold up from the validation to the cross-validation sample may have been due to different proportions of P-boat pilots being included in the two samples.

of selection data, i.e., in terms of type of type of plane flown[29] these preliminary studies emphasized the fact that the BI should be scored differently for predicting combat efficiency than in predicting training success. Following is given tabular breakdown, comparing Combat Key number 3 with three keys developed for prediction of success in training (Training keys X, Y, and Z).

Answers which are:	Training Keys Key X	Key Y	Key Z
Wrongs common to both training and Combat Keys:	9	11	5
Rights common to both training and Combat Keys:	14	6	5
Direct contradictions:	16	8	13
Right on Combat Key but not scored on training keys	36	46	47
Wrong on Combat Key but not scored on training keys	43	47	48

It is evident that there is relatively little in common between the training and Combat Keys.

Subsequent Work on "Checklist" Sample

Developmental work on BI Combat Keys previously discussed was carried out in terms of data collected during preliminary phases of the data collection program described in Chapter II. One major limitation of this previous work was that the samples available were for the most part very small. At least in part because of this limitation it was not possible to control the analyses adequately in terms of rank, age, specialty, etc. With the collection of additional data more exclusively from the combat areas in the course of the large scale field investigation described in Chapter III, an attempt towards a more definitive development of Combat Keys for the BI was made.

Samples Employed. This analysis utilized subjects for whom criterion data had been collected by the checklist method. One standardization (or

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[29]The analysis suggested that certain responses on the BI should be scored positively for CV pilots and negatively for P-boat pilots, and vice versa. Another practical implication of considerable importance was the suggested utility of the BI in predicting success in different specialties. The biserial coefficient between High P-boat pilots and all other subjects was .31 (on key 3).

original validation) group and three cross-validation groups were set up. Because of the importance of treating as homogeneous groups as possible (as indicated in the analysis of the air group sample) both the standardization and cross-validation groups were selected to be homogeneous in terms of Rank (rank when the respondent knew the man); Specialty (Single engine vs. Multi-engine) and Date of completing training (year of training completion.)

The standardization group consisted of 327 Highs and 242 Lows, all Lts. (jg) USNR, Single Engine pilots, completing training in 1943. The three cross-validation groups were:

(a) USNR Ensigns, Single Engine Specialties, Completing Training in 1944 (BI papers available for 155 Highs, 221 Lows).

(b) USNR Lt. (jg)'s, Multi-Engine Specialties, Completing Training in 1943 (BI papers available for 104 Highs, 72 Lows).

(c) USNR Ensigns, Single Engine Specialties, Completing Training in 1944 (BI papers available for 93 Highs, 72 Lows).

All cases were sorted out of the complete set of 4325 combat criterion cases obtained during April-July, 1945 by the check list method. The standardization groups of High and Low pilots were selected in such a way as to maximize their N.

Item Analysis. The Biographical Inventory data from the standardization group was subjected to item analysis. Weighting of the items was determined through use of the following criterion:

a. a difference in percentage of 5 per cent or greater between Highs and Lows, and

b. a difference statistically significant at the 5 per cent level of confidence or better.

This item analysis yielded a key carrying 26 positive weights and 28 negative weights, the score on the test being Number of Rights minus Number of Wrongs plus 30, the constant being added to eliminate negative scores.

The distributions for the standardization or original validation group, the three cross-validation groups separately, and the three cross-validation groups pooled are given in Table 6.25 and 6.26. As would be expected, marked differences in the distributions for the validation group are evident.

Discrimination on Cross-Validation Samples. However, the crucial test of the Combat Key is its cross-validation on samples which do not include any of the standardization cases. The distribution of scores, in terms of this "Combat Key" for each of the cross-validation groups are presented in Table 6.26, as well as the distribution for the pooling of the cross-validation groups. The mean scores of the three High cross-validation groups are, respectively 32.18, 32.14 and 31.62. The mean scores of the three Low cross-

TABLE 6.25

DISTRIBUTION OF SCORES ON BIOGRAPHICAL INVENTORY, COMBAT CRITERION KEYS, FOR STANDARDIZATION GROUP

Score	HIGHS N	HIGHS Cum. %	LOWS N	LOWS Cum. %
48	1	1.00		
47	1	1.00		
46	2	.99		
45	2	.99		
44	1	.98		
43	4	.98	2	1.00
42	4	.97		
41	8	.95	1	.99
40	12	.93		
39	10	.89	4	.99
38	14	.86	1	.97
37	23	.82	2	.97
36	14	.75	7	.96
35	23	.71	12	.93
34	15	.64	5	.88
33	20	.59	8	.86
32	22	.53	14	.83
31	37	.46	16	.77
30	28	.35	25	.70
29	17	.26	22	.60
28	21	.22	14	.51
27	16	.15	22	.45
26	7	.10	18	.36
25	8	.08	11	.29
24	6	.05	14	.24
23	2	.03	11	.18
22	2	.03	11	.14
21	2	.02	7	.09
20	2	.02	5	.06
19	1	.01	4	.04
18	1	.01	3	.02
17			2	.01
16	1	.03	1	.04
N	327		242	
M	32.65		28.18	

TABLE 6.26

DISTRIBUTION OF SCORES ON BIOGRAPHICAL INVENTORY, COMBAT CRITERION KEYS, FOR CROSS-VALIDATION GROUPS

	Single Engine Ensigns				Multi-Engine Lts. (Jg)				Multi-Engine Ensigns				All Cross-Validation Groups			
	HIGH		LOW		HIGH		LOW		HIGH		LOW					
Score	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
48																
47																
46																
45			1	1.00											1	1.000
44	1	1.00					1	1.00	1	1.00			2	1.000	1	.997
43	1	.99	1	.99	1	1.00			1	.99			3	.994	1	.995
42	2	.99	2	.99	1	.99			1	.98	2	1.00	4	.986	4	.992
41	3	.98	3	.98	2	.98			2	.97			7	.975	3	.981
40	5	.96	4	.97	2	.96			2	.95	1	.97	9	.956	5	.973
39	3	.93	3	.95	2	.94			1	.92	1	.96	6	.931	4	.959
38	3	.91	5	.94	5	.92	2	.99	4	.91	4	.94	12	.914	11	.948
37	11	.89	7	.91	6	.87	3	.96	4	.87	2	.89	21	.881	12	.918
36	14	.82	8	.88	7	.82	4	.92	4	.83	2	.86	25	.823	14	.885
35	10	.74	13	.85	5	.75	5	.86	4	.78	1	.83	19	.754	19	.847
34	9	.68	17	.79	6	.70	3	.79	9	.74	3	.82	24	.701	23	.795
33	16	.62	11	.71	10	.64	3	.75	5	.64	5	.78	31	.635	19	.732
32	16	.53	26	.66	8	.55	10	.71	8	.59	1	.71	32	.550	37	.679
31	8	.43	17	.54	14	.47	5	.57	10	.51	9	.69	32	.461	33	.578
30	12	.38	13	.47	6	.34	5	50	5	.40	8	.57	23	.373	26	.493
29	14	.31	26	.41	7	.28	4	.43	4	.34	6	.46	25	.309	36	.422
28	11	.22	11	.29	6	.21	3	.37	7	.30	7	.38	24	.240	21	.323
27	8	.16	13	.24	4	.15	5	.33	6	.23	4	.28	18	.174	22	.266
26	7	.11	11	.18	4	.12	7	.26	4	.16	7	.22	15	.124	25	.206
25	5	.07	2	.13	3	.08	5	.17	2	.12	2	.13	10	.083	9	.137
24	2	.04	8	.12	2	.05	3	.10	6	.10	1	.10	10	.055	12	.112
23	2	.02	5	.09	3	.03	1	.06	2	.03	4	.08	7	.028	10	.079
22	1	.01	7	.06			0		1	.01	2	.03	2	.008	9	.052
21			4	.03			2	.04							6	.027
20			1	.01											1	.011
19			1	.01			1	.01							2	.008
18			1	.04											1	.003
17	1	.01											1	.003		
16																
N	165		221		104		72		93		72		362		365	
M	32.18		30.79		32.14		30.19		31.62		30.33		32.03		30.58	

validation groups are, respectively, 30.79, 30.19 and 30.33. These differences while small appear consistent, and the difference between the means of all three groups combined (32.03 for all High cross-validation cases and 30.58 for all Low cases) is significant, having a critical ratio of 4.08. Moreover, treating the distributions for all cross-validation cases in terms of a 3 x 2 contingency table, as below, yields a chi-square of 12.26 which, for two degrees of freedom, is well below the 1 per cent level of confidence.

Score	HIGHS	LOWS	Total
34-45	132	98	230
28-33	167	170	337
17-27	63	97	160
	362	365	727

Discrimination in Cross-Validation Samples at Point of Maximum Differentiation in Standardization Samples. A still more enlightening picture is given by considering the differentiation indicated for the cross-validation groups at the point in the distribution which yielded the greatest differentiation on the original validation group. Reference to Table 6.25 indicates that in terms of the original standardization group the greatest differentiation between Highs and Lows is evident at a cutting score of 30 (i.e., by cutting the distribution between the scores of 30 and 29.) The chi-squared yielded by this breakdown is, of course, highly significant, which is to be expected, and in itself has little meaning.

However, cutting the distributions for the first cross-validation sample (See Table 6.26) at this point yields a chi-squared of 2.76, significant at just below the 10 per cent level of confidence. Cutting the distribution for the second cross-validation sample at the same point yields a chi-squared of 4.78 significant at between the 2 per cent and 5 per cent levels of confidence. Cutting the distribution for the third cross-validation group at this same point yields a chi-squared of 4.84, also significant at between the .02 and .05 levels of confidence. Cutting the distribution for the pooled data from all three cross-validation groups at this point yields a "pooled chi-squared" of 10.83, significant at below the 1 per cent level. Similarly the sum of the chi-squares for the individual groups yields a "total chi-squared" of 10.38, which, for three degrees of freedom, is also significant at below the 1 per cent level.

Thus, not only are the distributions for High and Low subjects in the pooled cross-validation group significantly different, but statistically significant differentiation is evident, for the pooled distributions at the cutting score which yielded maximum differentiation on the standardization group. More important still, use of the cutting score yielding maximum differentiation on the standardization group yielded, in turn, differentiation statistically significant at below the 5 per cent level of confidence on two of the three independent cross-validation groups, and significant at just

below the 10 per cent level on the third. This evidence of differentiation at the same point on three independent cross-validation samples is particularly noteworthy. This is especially true since these samples were homogeneous in terms of rank and date of completing training. It is of importance that this key, unlike those derived in the preliminary work, discriminated toward the low ends of the distribution of scores, and not almost exclusively at the high ends of the distributions.

Admittedly, despite this fact and despite the evidence of statistical significance, the differentiation at this cutting score alone would be of somewhat doubtful practical value. Use of this cutting score would have eliminated, in the first cross-validation sample 47 per cent of the Lows and 38 per cent of the Highs; in the second sample 50 per cent of the Lows and 34 per cent of the Highs; and in the third sample 57 per cent of the Lows and 40 per cent of the Highs. These figures are less impressive when it is recognized that rather extreme criterion groups were involved.

Nevertheless, the evidence of statistical significance, and of the relative stability of prediction from sample to sample, indicates that this criterion can be predicted, and suggests considerable promise for measures of this type as predictive instruments of combat effectiveness (as defined by the criteria), or for other test measures covering the fundamental psychological variables sampled by the BI.[30]

It should be pointed out that this present study was concerned only with the differentiation of <u>all</u> Highs and <u>all</u> Lows, regardless of the reasons for nomination. If large enough standardization and criterion groups were available, it would be profitable to develop BI keys to discriminate particular groups of Highs and Lows, e.g., between "good mixers" (socially) and "poor mixers." However, in general the criterion groups available were not large enough to establish stable BI keys, unless dependence was placed on the "uncircled categories" (punched in cols. 27-45, 52-56, 58-59 on Code E card). However, if this is done, it will be found (in general) that samples of cases nominated for specific reasons will represent a sizeable proportion of all cases (up to 99% for some categories in fact) so that comparison of specific category groups is almost tantamount to comparison of all Highs and all Lows. The difficulties in interpreting such data are obvious.

SUMMARY CONSIDERATIONS OF COMBAT CRITERION PREDICTION STUDIES

In general it can be said that there is little evidence that test procedures which have proved useful in predicting success in flight training

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[30] It might be noted that if other measures which showed a predictive efficiency comparable to that demonstrated for the BI, and which were relatively uncorrelated with it, were available, combination of such measures in a battery with the BI might yield quite adequate prediction of the criterion. In this connection it is perhaps unfortunate that there were not more items of the "personality inventory" type included in the Biographical Inventory.

have utility in predicting the combat criterion. Certain relationships which were evident could, in large part, be attributed to the spurious effect of extraneous variables, in particular rank and experience. The relationships between test scores and an unbiased criterion measure (adjusted in terms of rank and experience) did not differ significantly from zero. Admittedly these coefficients may have been attenuated by limitations of the sample in terms of which the work was done, or by inadequacies in the procedure for adjusting the nomination score to produce an unbiased measure. In this regard, however, two points are paramount.

(1) the correlations between the tests and even the biased criterion while in some cases approaching statistical significance, were not of a magnitude (less than .10) associated with practical predictive significance, and

(2) whether or not the adjusted nomination score could be considered adequate or inadequate, the importance, in further research, of controlling in terms of such factors as rank and experience appeared incontrovertably demonstrated.

Promise was, however, indicated for "Combat Keys" developed for scoring the Biographical Inventory. These keys, on samples homogeneous in terms of rank and experience, yielded meaningful discrimination over three independent cross-validation samples. While these results did not necessarily indicate, in themselves, extensive practical predictive significance for the keys, the possibility of development instruments for the prediction of this type of combat criterion was quite clearly indicated.

CHAPTER VII

ANALYSIS OF RELATIONSHIPS AMONG REASONS FOR NOMINATION

INTERRELATIONSHIPS AMONG REASONS FOR NOMINATION

From reference to Chapter VI it will be recalled that efforts were made toward grouping into clusters the categories into which the free response material fell. Since more rigorous statistical procedures appeared inapplicable, grouping of items on the basis of rational considerations was done by personnel in the Aviation Psychology Branch, and by a group of experienced combat pilots. APB personnel grouped the categories into five clusters: Teamwork, Emotional Stability, Practical Intelligence, Officer-like Qualities, and Basic and Accessory Skills. The pilots produced six clusters, which, expressed in terms of negative characteristics, were: Lacking in Teamwork, Lacking in Motivation for Combat Aviation, Emotionally Inadequate, Intellectually or Perceptually Inadequate, Lacking Minimal Skills, and Immature.[1]

It was anticipated that more rigorous statistical determination of the interrelationships among reasons for nomination would be possible when more definitive data from a larger number of respondents became available. Data collected during Phase II of the major investigation, in which reasons for nomination were obtained by the checklist method, made such definitive analysis possible. A more rigorous determination of "clusters" of items, or of the "factors" underlying the indicated reasons for nomination, is of great practical as well as theoretical importance. On the theoretical side, information as to the fundamental characteristics of good and poor combat pilots would represent basic knowledge. The implications of such findings for selection are obvious. On the practical side, much time in validity studies and item analysis studies could be saved if the relatively large number of reasons for nomination could be combined into a small number of superordinate classifications.

Intercorrelations Among Checklist Item Reasons for Nomination

The intercorrelations among reasons for nomination as indicated by the marking of checklist items were determined on the basis of a random sample of 1800 High nominees, and on the basis of a random sample of 1800 Low nominees. Tetrachoric coefficients were computed, the four-fold tables being set up as indicated below.

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[1] Interrelationships between categories in these various clusters are presented graphically in Appendix 2-C.

		Reason X		
		Marked	Not Marked	
Reason Y	Not Marked			
	Marked			

The correlations were computed in terms of "circled" reasons, i.e., the frequencies in each cell represented frequencies of use of items as one of the three outstanding reasons for nomination. It should also be noted that only one set of reasons for nomination assigned to any given nominee was used. In other words, in the case of multiply nominated nominees, data from only the first line of the multiple nomination card was used, i.e., only the reasons checked by one of the respondents nominating the officer in question were used. The selection of data from a particular respondent, in the case of multiply nominated officers, can be considered essentially random. The intercorrelations of reasons for nominating High are presented in Table 7.01; the intercorrelations of reasons for nominating Low are presented in Table 7.02.[2]

Inspection of these two tables indicates that the intercorrelations among reasons for High nomination are, in general, greater than are the intercorrelations among reasons for Low nominations. This is in line with the implication of previous analysis suggesting that respondents assigned fewer reasons for Low, than for High, nominations, and assigned such reasons with greater specificity.

FACTOR ANALYSES OF REASONS FOR NOMINATION

Factor analysis techniques were employed to determine the "factors" or basic clusters underlying the interrelationships among item reasons for nomination. The purpose of the factor analysis was expressed as follows: "To determine the basic factors which explain the intercorrelations among a set of reasons most commonly given by combat experienced pilots for selecting men with whom they did want to fly on future combat missions, and also among a set of reasons given for selecting men with whom they did not want to fly on future combat missions."[3]

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[2]The detailed procedures employed in sorting the reasons for nomination and setting up the four-fold tables are included in a report on file in the Aviation Psychology Branch, Division of Aviation Medicine, Bureau of Medicine and Surgery, United States Navy.

[3]Combat criterion studies, Report of Factor Analysis of Low Group and High Group. Aviation Psychology Branch, Division of Aviation Medicine, Bureau of Medicine and Surgery, United States Navy. On file in the Aviation Psychology Branch.

TABLE 7 C1

INTERCORRELATIONS OF CHECK LIST REASONS FOR NOMINATION FOR HIGH
CORRELATIONAL MATRIX

N-1800

Category	1	2	3	4	5	6	7	8	9	10	11
1.		.38	.23	.34	.27	.32	.20	.36	.38	.36	.29
2.	.38		.30	.36	.30	.37	.22	.29	.34	.36	.31
3.	.23	.30		.35	.16	.28	.14	.34	.36	.46	.52
4.	.34	.36	.35		.28	.37	.30	.47	.40	.30	.43
5.	.27	.30	.16	.28		.41	.37	.43	.23	.20	.23
6.	.32	.37	.28	.37	.41		.28	.52	.44	.26	.33
7.	.20	.22	.14	.30	.37	.28		.24	.28	.13	.22
8.	.36	.29	.34	.47	.43	.52	.24		.25	.22	.20
9.	.38	.34	.36	.40	.23	.44	.28	.25		.44	.40
10.	.36	.36	.46	.30	.20	.26	.13	.22	.44		.46
11.	.29	.31	.52	.43	.23	.33	.22	.20	.40	.46	
12.	.34	.38	.17	.39	.48	.48	.46	.50	.33	.20	.10
13.	.16	.26	.62	.43	.10	.42	.14	.31	.29	.40	.48
14.	.54	.40	.38	.38	.23	.32	.06	.33	.40	.37	.38
15.	.30	.44	.29	.37	.40	.47	.31	.40	.27	.27	.30
16.	.34	.45	.24	.28	.48	.48	.28	.50	.26	.28	.20
17.	.42	.40	.32	.24	.38	.35	.42	.50	.30	.29	.40
18.	.30	.32	.33	.48	.34	.46	.52	.49	.41	.25	.35
19	.12	.40	.27	.40	.34	.30	.38	.28	.30	.25	.39
20.	.26	.29	.26	.44	.38	.37	.44	.40	.38	.23	.34
21.	.43	.61	.39	.34	.33	.39	.22	.35	.36	.44	.32
22.	.28	.32	.24	.47	.38	.34	.40	.44	.31	.20	.28

TABLE 7.01 (Continued)

12	13	14	15	16	17	18	19	20	21	22
[illegible]	.16	.54	.30	.34	.42	.30	.12	.26	.43	.28
.18	.25	.40	.44	.45	.40	.32	.40	.29	.61	.32
.27	.62	.36	.29	.24	.32	.33	.27	.26	.39	.24
[illegible]	.40	.38	.37	.28	.24	.48	.40	.44	.34	.47
.18	.10	.23	.40	.48	.38	.34	.34	.38	.33	.38
.43	.22	.32	.47	.48	.35	.46	.30	.37	.39	.34
[illegible]	.17	[illegible]	.31	.28	.42	.52	.38	.44	.22	.40
	.32	.30	.40	.50	.50	.49	.28	.40	.35	.44
[illegible]	[illegible]	[illegible]	.27	.26	.30	.41	.30	.38	.36	.31
[illegible]	.40	.37	.24	.25	.29	.25	.25	.23	.44	.20
[illegible]	.40	.35	.30	.20	.40	.35	.39	.34	.32	.28
	.29	.30	.43	.56	.51	.50	.24	.39	.36	.46
.14		.22	.20	.22	.30	.40	.26	.28	.24	.29
[illegible]	.22		.28	.34	.38	.27	.10	.23	.46	.24
[illegible]	.20	.22		.40	.45	.37	.42	.47	.42	.53
.56	.22	.34	.40		.44	.38	.26	.36	.34	.34
.51	.30	.38	.45	.44		.24	.30	.37	.42	.36
.50	[illegible]	.27	.27	.38	.24		.36	.45	.38	.42
[illegible]	.26	.10	.42	.26	.30	.36		.43	.30	.53
[illegible]	.28	.28	.44	.36	.37	.45	.43		.30	.48
.35	[illegible]	.46	.42	.34	.42	.28	.30	.30		.20
.46	.29	.24	.53	.34	.36	.42	.53	.48	.20	

TABLE 7 [illegible]

INTERCORRELATIONS OF CHECK LIST REASONS FOR NOMINATION FOR LOW
CORRELATIONAL MATRIX

N-1800

	1	2	3	4	5	6	7	8	9	10	11	12	13
[illegible]		-.12	.08	-.08	.00	-.02	.02	.08	.22	.03	.19	.20	.36
[illegible]	-.12		[illegible]	[illegible]	.20	.26	-.20	.03	.28	.13	-.04	.12	-.10
[illegible]	.08	[illegible]		.02	[illegible]	-.32	.08	-.06	.31	.54	.36	-.05	.23
[illegible]	-.08	.10	.02		.44	.36	-.16	.72	.11	.08	.10	.42	.14
[illegible]	.00	.20	-.10	.44		.52	-.13	.53	.03	.03	.06	.45	.04
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		-.11	[illegible]	.02	-.04	.02	.44	-.02
[illegible]	[illegible]	-.20	[illegible]	[illegible]	-.12	.11		.00	.11	.05	.18	.16	.24
[illegible]	.08	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.08		[illegible]	-.14	.20	.52	.20
[illegible]	[illegible]	.28	[illegible]	[illegible]	.03	.32	.11	.11		.44	.22	.08	.02
[illegible]	.08	[illegible]	[illegible]	.08	.03	.04	.05	-.14	.44		.13	.00	.02
[illegible]	.19	[illegible]	.26	.10	.06	.02	.18	.20	.22	.13		.10	.24
[illegible]	[illegible]	[illegible]	[illegible]	.12	.45	.44	.16	.52	.08	.00	.10		.10
[illegible]	.36	-.10	.23	.14	.04	-.02	.24	.20	.02	.02	.24	.10	
[illegible]	.22	[illegible]	.15	.28	.07	.00	-.28	-.10	.40	.31	.04	.09	-.10
[illegible]	.02	.34	.05	.22	.44	.42	.12	.40	.10	.04	.09	.35	.00
[illegible]	[illegible]	.44	[illegible]	.28	.44	.40	.02	.30	.30	.18	.09	.33	.00
[illegible]	.10	[illegible]	.29	.10	.19	.18	.14	.24	.28	.28	.40	.22	.18
[illegible]	.38	.00	.30	.12	.10	.05	.30	.18	.12	.17	.12	.26	.44
[illegible]	[illegible]	.10	[illegible]	-.02	.12	.09	.54	.19	-.01	-.14	.14	.19	.20
[illegible]	.20	[illegible]	.08	.04	.40	.36	.14	.43	.10	.03	.10	.44	.24
[illegible]	.08	.56	.01	.20	.22	.34	.08	.08	.24	.14	.02	.18	-.08
[illegible]	.09	-.14	-.12	.36	.50	.34	.00	.50	-.16	.18	.07	.36	.24
[illegible]	.27	.20	.29	.17	.14	.42	.05	.10	.32	.44	.07	.10	-.02
[illegible]	-.04	.18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.40	.06	.02	.07	.40	-.06
[illegible]	.02	.39	.32	.04	.00	-.04	-.08	-.14	.53	.55	.08	-.10	-.10
[illegible]	[illegible]	.14	.16	.15	.02	.02	.33	.00	.46	.34	.12	.10	.00

TABLE 7.02 (Continued)

Category	14	15	16	17	18	19	20	21	22	23	24	25	26
1.	-.22	.02	.02	.18	.38	.46	.20	.08	.09	.25	-.04	-.02	.35
2.	.44	.34	.44	.12	.00	.00	.06	.56	-.11	.20	.26	.39	.14
3.	.15	.03	.00	.29	.30	.04	.06	.01	-.12	.20	-.05	.32	.16
4.	.28	.22	.29	.10	.12	-.02	.34	.20	.36	.17	.37	.04	.15
5.	.07	.44	.44	.19	.10	.12	.40	.22	.50	.16	.60	.00	.02
6.	.00	.42	.40	.16	.05	.09	.36	.34	.34	.22	.54	-.04	.02
7.	-.28	.12	.02	.14	.30	.54	.14	.08	.00	.08	-.12	-.08	.38
8.	-.10	.40	.30	.24	.18	.19	.43	.08	.50	.10	.40	-.14	.00
9.	.40	.10	.30	.28	.12	-.01	.10	.24	-.16	.32	.06	.53	.46
10.	.31	.04	.10	.28	.17	-.14	.03	.14	-.18	.44	.06	.55	.34
11.	.04	.09	.09	.40	.12	.14	.10	.02	.07	.07	.07	.08	.12
12.	.04	.35	.33	.22	.26	.19	.44	.18	.36	.10	.40	-.10	.10
13.	-.10	.00	.00	.18	.44	.20	.24	-.08	.24	-.02	-.06	-.10	.00
14.		.09	.40	.00	-.13	-.18	.06	.22	-.16	.10	.15	.48	.17
15.	.09		.42	.18	.15	.21	.48	.40	.36	.20	.40	.07	.14
16.	.40	.42		.13	.17	.02	.32	.42	.14	.20	.42	.24	.22
17.	.00	.18	.18		.23	.17	.32	.25	.07	.26	.17	.16	.14
18.	-.13	.15	.17	.23		.22	.21	.04	.19	.23	.12	.07	.30
19.	-.18	.21	.02	.17	.22		.24	.24	.24	.04	-.05	-.22	.06
20.	.06	.48	.32	.32	.21	.24		.24	.44	.16	.35	.05	.22
21.	.22	.40	.42	.25	.04	.24	.24		-.03	.27	.30	.24	.20
22.	-.16	.36	.14	.07	.19	.24	.44	-.03		-.07	.44	-.21	-.06
23.	.10	.20	.20	.26	.23	.04	.16	.27	-.07		.14	.36	.56
24.	.15	.40	.42	.27	.12	-.03	.35	.30	.44	.14		.12	.16
25.	.48	.07	.24	.16	.07	-.22	.05	.24	-.21	.26	.12		.45
26.	.12	.14	.22	.14	.30	.06	.22	.20	-.06	.56	.16	.45	

Procedures

The Thurstone Centroid method of analysis was employed.[4] Nine factors were extracted on the basis of the correlation matrices for both High and Low reasons for nomination. The Centroid factor matrix for the High group is presented in Table 7.03; for the Low group in Table 7.04. The "communalities" (h^2) in the right-hand column of these tables indicate the extent to which the common factors account for the variance of the categories.

The Centroid factors were rotated by Tucker's rotational method[5] and by other techniques until a solution was obtained which was as nearly orthogonal as possible, and which at the same time satisfied the requirements of simple structure.[6] The implications of orthogonal structure in relation to character traits is discussed later in this chapter. The significance of the first condition (orthogonality) is that the basic factors obtained are relatively uncorrelated. The significance of simple structure is that each item (or reasons for nomination) has zero, or nearly zero, loadings on as many factors as possible.

The rotated factor matrix for Highs is presented in Table 7.05; for Lows in Table 7.06.[7] The transformation matrices for the High and Low analyses are presented in Appendix 7-A. The presence of "simple structure" is indicated through reference to these tables by the fact that in general each of the respective items shows low factor loadings on all but one or two factors. It is also noteworthy at least with reference to the High analysis that loadings of appreciable magnitude are in general positive.

The procedures for rotation employed[8] permitted oblique rotation. It is therefore pertinent to inquire into the correlations among the factors. The intercorrelations among factors for the High group, are given in Table 7.07. The intercorrelations among the factors for Low are presented in Table 7.08. These matrices of intercorrelations are derived from the inverse of the matrices of cosines between the factors. The cosine matrices are presented in Appendix 7-B.

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[4] Thurstone, L. L. Multiple-factor analysis. Chicago, University of Chicago Press, 1947.

[5] Tucker, Ledyard, R. Semi-analytical method of factorial rotation to simple structure. Psychometrika, 1944, 9, 43-68.

[6] A more detailed presentation of certain of the procedures employed in this factor analysis is included in the report in the files of the Aviation Psychology Branch.

[7] The transformation matrices for the two sets of rotations are presented in Appendix 7-A.

[8] Tucker, Ledyard, R. Op. cit.

TABLE 7.03

CENTROID FACTOR MATRIX F_0, FOR HIGH GROUP

Factor

Category	I	II	III	IV	V	VI	VII	VIII	IX	h^2
1	.550	-.224	.258	-.278	-.164	.131	.070	.042	.043	.55[illegible]
2.	.623	-.155	.205	.222	-.228	-.137	-.138	-.131	.160	.636
3.	.558	-.393	-.248	.058	.274	-.155	.070	-.058	-.110	.650
4.	.637	.049	-.220	-.163	.1[illegible]4	-.104	.201	-.202	.075	.594
5.	.553	.286	.176	.140	.060	.134	.008	.140	.018	.430
6.	.636	.139	.141	.091	.114	.165	.117	-.173	-.092	.544
7.	.502	.316	-.161	-.119	-.022	.103	-.432	.190	-.068	.630
8.	.641	.211	.167	-.141	.262	-.165	.182	-.070	-.090	.645
9.	.574	-.166	-.155	-.059	-.111	.299	.079	-.105	.023	.504
10.	.525	-.397	-.079	[illegible]	.036	.085	.041	.019	.155	.484
11.	.572	-.324	-.309	.095	.072	.106	.058	.164	-.110	.595
12.	.636	.353	.233	-.151	.107	-.060	-.137	-.030	.096	.676
13.	.509	-.256	-.383	-.039	.350	-.2[illegible]	.038	-.082	.102	.683
14.	.553	-.349	.234	-.208	-.109	.095	.217	-.066	-.047	.596
15.	.640	.176	.094	.167	-.112	-.126	.064	.088	-.138	.53[illegible]
16.	.614	.153	.303	.064	.208	.031	.010	.027	.190	.533
17.	.637	-.049	.226	-.103	.067	-.112	-.112	.323	-.141	.624
18.	.654	.215	-.199	-.139	.059	.106	.123	-.308	-.092	.657
19.	.550	.172	-.282	.235	-.220	-.127	-.032	.13[illegible]	.024	.578
20.	.621	.224	-.158	-.043	-.130	.059	.066	.082	-.136	.513
21.	.631	-.260	.246	.158	-.144	.054	-.183	-.20[illegible]	-.098	.561
22.	.616	.316	-.1[illegible]0	.064	-.173	-.172	.273	.153	.112	.643

[illegible]

[illegible] FACTOR MATRIX, F_0, FOR LOW GROUP

Factor

Category	I	II	III	IV	V	VI	VII	VIII	IX	h^2
1.	.360	.200	-.582	-.306	.068	-.038	-.172	-.057	-.174	.671
2.	.374	-.416	.387	-.232	-.227	-.135	.167	.031	.168	.643
3.	.304	-.284	-.410	.339	-.133	-.042	.275	-.038	.125	.568
4.	.450	.122	.233	.232	.165	-.187	-.103	.071	-.144	.481
5.	.539	.296	.438	.109	.168	.090	.084	-.130	-.128	.659
6.	.470	.222	.442	-.109	.131	.126	.163	-.108	-.029	.550
7.	.252	.200	-.576	-.454	-.097	.108	-.239	-.087	.070	.714
8.	.472	.511	.2[illegible]7	.116	.082	-.025	.056	.033	-.149	.587
9.	.453	-.499	-.178	.068	-.043	.026	-.230	-.097	-.061	.559
10.	.37[illegible]	-.532	-.250	.254	.145	.064	.138	-.152	.100	.625
11	.324	.058	-.289	.296	-.253	.083	-.008	-.147	.093	.381
12	.542	.351	.202	-.029	.077	-.160	-.139	-.199	.215	.602
13	.258	.299	-.353	.178	-.119	-.330	.045	.163	.153	.487
14	.246	-.527	.318	.205	-.162	-.224	-.295	-.071	.030	.657
15	.553	.122	.305	-.163	-.147	.195	.091	.166	-.090	.549
16	.580	-.132	.356	-.091	-.031	.004	-.082	-.088	-.052	.514
17	.481	.017	-.209	.181	-.183	.214	.186	-.060	.047	.428
18	.433	.142	-.361	-.043	.111	-.260	.095	.103	.094	.448
19	.304	.359	-.275	.338	-.268	-.012	.018	-.031	-.030	.485
20	.588	.297	.100	.049	-.055	.099	-.070	.208	-.108	.519
21	.491	-.218	.241	-.362	-.244	.077	.129	.028	.064	.565
22.	.339	.595	.206	.193	.114	.047	-.031	.148	.171	.616
23.	.489	-.326	-.157	-.127	.364	.039	.244	.068	-.210	.628
24	.528	.143	.442	.004	.215	.176	-.025	-.084	-.153	.607
25	.344	-.683	-.026	.168	.084	.077	-.070	.126	.099	.657
26	.481	-.310	-.292	-.185	.313	.151	-.300	.291	-.121	.757

TABLE 7.[illegible]

ROTATED FACTORIAL MATRIX, HIGH GROUP

Category	A	B	C	D	E	F	G	H	K
1.	-.07	.01	.14	-.01	.33	.07	-.07	.39	-.03
2.	-.02	.02	.04	.51	-.07	-.05	.06	-.01	-.05
3.	.59	.00	.19	.03	.05	-.03	-.05	.03	.12
4.	.03	-.07	.49	.05	.01	-.01	.17	.22	.12
5.	-.07	.38	-.07	-.01	.00	.03	.20	.08	.10
6.	-.05	.31	.11	.03	-.04	-.03	.05	.17	.34
7.	.00	-.01	.00	-.01	.05	.56	.04	.04	.00
8.	.02	.33	.37	-.08	.18	.02	.06	-.03	.24
9.	.12	-.04	.11	-.03	-.02	.05	.01	.48	.12
10.	.36	.07	.02	.08	-.04	-.08	-.03	.27	-.11
11.	.52	-.03	-.03	-.07	.08	.00	.12	.27	.06
12.	-.21	.33	.25	.05	.07	.27	-.03	-.02	.04
13.	.58	.04	.39	-.03	-.07	.06	-.07	-.02	-.06
14.	.04	-.01	.18	.00	.32	-.10	-.06	.39	.11
15.	.00	.12	.04	.20	.13	-.06	.35	-.06	.20
16.	-.03	.50	.07	.00	-.04	.02	-.01	.09	-.01
17.	.16	.15	-.01	.01	.42	.18	.07	.00	-.02
18.	-.02	.01	.35	.04	-.12	.34	-.08	.18	.22
19.	.14	-.05	.01	.24	-.10	-.03	.47	-.04	.02
20.	.01	.00	.15	-.03	.12	.10	.31	.19	.20
21.	.03	-.03	-.02	.47	.06	.04	-.10	.02	.18
22.	-.04	.05	.32	.00	.09	-.01	.47	.08	-.04

TABLE [illegible]

ROTATED FACTORIAL MATRIX, LOW GROUP

Category	A	B	C	D	E	F	G	H	K
1.	-.02	.01	.12	-.13	.43	.59	.02	.00	-.10
2.	.01	-.03	.18	.61	-.09	-.05	-.02	.31	.17
3.	.60	-.12	.32	.00	.04	.14	.19	-.03	.06
4.	-.06	.26	.15	-.05	.06	-.08	.28	.25	-.12
5.	.06	.48	.00	.02	-.01	-.07	.06	.07	-.15
6.	.03	.42	.00	.20	-.03	-.06	-.03	-.04	-.03
7.	.02	-.01	-.10	-.01	.37	.57	-.05	-.01	.12
8.	-.03	.31	.06	.00	-.08	.08	.27	-.04	-.16
9.	.30	-.02	.03	-.03	.36	.09	.04	.38	-.05
10.	.55	.09	.26	-.10	.32	-.03	-.01	.08	.08
11.	.49	.03	-.02	-.10	-.07	.22	.18	.06	.01
12.	.03	.54	.09	.01	.04	.24	.08	.26	.23
13.	.12	-.08	.34	-.01	-.01	.35	.42	.03	.14
14.	.09	.00	.00	.10	-.02	-.15	.07	.67	.02
15.	-.01	.05	-.10	.42	-.01	-.04	.23	-.01	-.09
16.	.04	.22	-.01	.27	.05	.02	.04	.35	-.05
17.	.52	.04	.03	.09	.01	.14	.19	-.10	-.02
18.	.09	.05	.43	.02	.23	.37	.26	-.01	.13
19.	-.03	-.05	.01	.22	.00	.53	.05	-.04	-.03
20.	.05	.09	-.05	.14	.09	.05	.42	.02	-.10
21.	.02	-.01	.02	.59	.02	.07	-.01	.15	.07
22.	.00	.35	-.04	-.04	-.07	-.07	.40	-.12	.16
23.	.13	.05	.37	.07	.52	.04	.01	-.12	-.15
24.	.03	.44	-.09	.01	.10	-.17	.07	.07	-.14
25.	.31	-.05	.10	.08	.37	-.27	.16	.23	.12
26.	-.04	-.06	.04	-.05	.78	-.02	.24	.08	.00

TABLE 7.07

CORRELATION MATRIX FOR FACTORS FOR HIGH GROUP

	A	B	C	D	E	F	G	H
A	1.00	.23	.25	.39	.16	.20	.16	[illegible]
B		1.00	.30	.60	.42	.41	.27	.40
C			1.00	.30	.12	.13	.17	.20
D				1.00	.46	.31	.19	.61
E					1.00	.04	-.05	.25
F						1.00	.60	.26
G							1.00	.22
H								1.00

TABLE 7.08

CORRELATION MATRIX FOR FACTORS FOR LOW GROUP

	A	B	C	D	E	F	G	H
A	1.00	-.18	.01	.09	.23	-.07	-.13	.19
B		1.00	-.13	.32	-.11	.15	.43	-.25
C			1.00	-.16	-.15	-.39	-.19	.12
D				1.00	.30	.02	.00	.03
E					1.00	.03	-.13	.07
F						1.00	.33	-.30
G							1.00	-.12
H								1.00

It will be noted from inspection of Tables 7.07 and 7.08 that while the correlations among the factors, in both analyses, are low, the factor intercorrelations are quite markedly lower, on the whole, for the Low than for the High analysis. This finding is in line with the evidence discussed in previous chapters of this report that Low subjects tended to be nominated for fewer, but more specific, reasons than did High nominees. However, the intercorrelations among High factors tended more generally to be positive than did the intercorrelations among Low factors. Among the latter, two negative coefficients as great as -.30 are evident.

The more detailed implications of these findings will be discussed following interpretation of the factors yielded by the analysis of data from the Highs and Lows, respectively. A summary over-all view of the factor structure can be obtained from the "skeleton factor matrices" presented in Tables 7.09 and 7.10 for the High and Low analyses, respectively. Only entries above .30 are included in these skeleton matrices. This level of "practical significance" was set arbitrarily, but is in line with usual practice.

In the following sections of this part of Chapter VII will be presented a brief interpretation of each of the factors, including a comparison of individual factors with the clusters of reason for nomination categories outlined by the panels of Psychologists, and Pilots, respectively, followed by a discussion of the general considerations relative to High and Low analyses; and finally a detailed comparison of the "core factors," i.e., respective High and Low factors which appeared comparable and could be considered counterparts.[9] In the presentation which follows immediately the implications of the structure of each factor will not be discussed in detail, such discussion being reserved for the presentation of "core factors" later in this chapter.

Interpretation of Factors in the High Group

Nine factors were yielded by the analysis on the High group, eight of which were psychologically meaningful. They may tentatively be designated as follows:

A. Easy-going sociability.	E. Leadership and responsibility
B. Practical Intelligence	F. Combat aggressiveness
C. Coolness, steadiness	G. Skill and interest in flying
D. Seriousness, conscientiousness	H. Teamwork

K. Residual, not interpreted

The structure of these factors in terms of major loadings (greater than .30) will be discussed below. Moreover, although the free response categories

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[9]This detailed comparison of pairs of High and Low factors has not been included in the initial presentation of the factors, immediately following. To do so, in addition to discussing comparability with reason for nomination category clusters, would have rendered the presentation too involved.

TABLE 7.09

SKELETON ROTATED FACTOR MATRIX FOR HIGH GROUP

Category	Sociability A	Practical Intelligence B	Coolness, Steadiness C	Seriousness, Attention to Duty D	Leadership & Responsibility E	Combat Aggressiveness F	Skill & Interest in Flying G	Teamwork H	Residual K
1.					.33			.39	
2.				.51					
3.	.59								
4.			.49						
5.		.38							
6.		.31							.34
7.						.56			
8.		.33	.37						
9.								.48	
10.	.36								
11.	.52								
12.		.33							
13.	.58		.39						
14.					.32			.39	
15.							.35		
16.		.50							
17.					.42				
18.			.35			.34			.32
19.							.47		
20.							.32		
21.				.47					
22.			.32				.47		

TABLE [illegible]

SKELETON ROTATED FACTOR MATRIX FOR HIGH GROUP

Category	Temperamental Unsociability A	Lack of Practical Intelligence B	Excitability, Lack of Coolheadedness C	Failure to take Job Seriously D	Reaction to Failure by Mental Mechanism E	Fear Syndrome F	Lack of Job Skill G	Foolhardy Individualism H	Residual K
1					.45	.59			
2				.61				.31	
3	.60		.32						
4									
5		.48							
6		.42							
7					.37	.57			
8		.31							
9	.30				.36			.38	
10	.55				.32				
11	.49								
12		.54							
13			.3[illegible]			.35	.42		
14								.67	
15				.42					
16								.35	
17	.50								
18			.43			.37			
19						[illegible]			
20							.42		
21				.59					
22		.35					.40		
23			[illegible]7		.52				
24		.44							
25	.31				.37				
26					.78				

were not directly comparable to the checklist items, comparison will be made between the factors yielded by the analysis and the Pilots, and Psychologists, authoritatively established "clusters" of free response categories.

Factor A: Easy-going sociability. Loadings on:

Item	Description	Factor A	Other Factors
3	Even-tempered and well-balanced on the ground.	.59	---
13	Easy-going and not easily excited.	.58	.39 Factor C
11	Gets along well with squadron mates; mixes well.	.52	---
10	Welcomes suggestions and reacts well to criticism.	.36	---

These four items pertain to "easy-going" and "sociability" characteristics. This "sociability" factor has no closely comparable counterpart among the Psychologists' or Pilots' clusters, although it exhibits some overlap with Pilots' Cluster 3, referred to "emotional adequacy". The free response categories analogous to Items 11 and 13 were also included in this cluster, which also, however, included the analogies of Items 4 and 8 which had reference to steadiness and coolness, in the air, and under difficult conditions.

Factor B: Practical Intelligence. Loadings on:

Item	Description	Factor B	Other Factors
16	Always thinks ahead and figures things out. Has a plan for any situation that is likely to come up.	.50	---
5	Alert. Knows what's going on every minute in the air.	.38	---
12	Accurately sizes up tactical situations.	.33	---
8	Thinks fast enough to reach wise decisions quickly.	.33	.37 Factor C
6	Gets the word quickly and remembers well.	.31	.34 Factor K (Res.)

This factor, with the particularly high loading on Item 16 would appear identifiable with "Practical Intelligence," and is a relatively clear factor. Only one item carries a loading, and a relatively small one, on another interpretable factor. One other item carries a small loading on the residual factor.

This factor "Practical Intelligence" is almost identical to the Pilots' Cluster 4 (Intellectual and perceptual adequacy) and to the Psychologists' Cluster 3 (Practical Intelligence). All of the items in Factor B are

included in both these clusters. Both clusters (which were, of course, based on Low reasons for nomination) also included the free response category analogue of Item 24, but there was no High counterpart for this item.

Factor C: Coolness, steadiness

Item	Description	Loadings on: Factor C	Other Factors
4	Steady and reliable in the air.	.49	---
13	Easy-going and not easily excited.	.39	.58 Factor A
8	Thinks fast enough to reach wise decisions quickly.	.37	.33 Factor B
18	Holds up well in tight spots.	.35	.34 Factor F; .32 Factor K
22	Excellent plane handler. Gets the most out of his airplane.	.32	.47 Factor G

Consideration of the loadings on this factor warrants labelling it "Coolness, Steadiness." Factor C shows considerable overlap with the Pilots' Cluster 3 (referring to emotional adequacy) which consisted of the free response analogues to Items 4, 11, 13, and 18; and some overlap with the Psychologists' Cluster 2 (referring to emotional stability) which contained categories analogous to Items 7, 18 and 13.

Factor D: Seriousness, conscientiousness

Item	Description	Loadings on: Factor D	Other Factors
2	Takes his job seriously.	.51	---
21	Carries out his responsibilities promptly and properly.	.47	---

This factor with relatively high loadings on only two items can be labelled "Seriousness, conscientiousness." Because of the fact that it includes only two items, identification with Pilots' and Psychologists' clusters is difficult. None of the psychologists' clusters contain both of these items. Both are included in the Pilots' Cluster 6 (pertaining to "Maturity"), which also included, however, five other categories.

Factor E: Leadership and responsibility

Item	Description	Loadings on: Factor E	Other Factors
17	He is a real leader of men. Has the respect and confidence of others.	.42	---
1	He feels responsible for the safety of all personnel flying in combat with him.	.33	.39 Factor H
14	Does not take foolish risks which endanger the lives of others.	.32	.39 Factor H

The items carrying loadings on this factor warrant the tentative designation "Leadership and responsibility," all of the items denoting behavior associated with this characteristic. It is to be noted that Items 1 and 14 also carry loadings on Factor H, "Teamwork." There is little indication of comparability of this factor with any of either the Pilots' or Psychologists' clusters.

Factor F: Combat aggressiveness — Loadings on:

Item	Description	Factor F	Other Factors
7	Is aggressive. Presses home the attack.	.56	---
18	Holds up well in tight spots.	.34	.35 Factor C; .32 Factor K

This factor, with loadings on only two items, appears identifiable with "Combat aggressiveness." It has no readily recognizable counterpart among the Pilots' clusters. As was the case with Factor C, some overlap with the Psychologists' Cluster 2 is evident, this cluster including categories analogous to Items 7, 18, and also 13. This Psychologists' cluster was designated "Emotional Stability."

Factor G: Skill and interest in flying — Loadings on:

Item	Description	Factor G	Other Factors
19	Loves to fly.	.47	---
22	Excellent plane-handler. Gets the most out of his airplane.	.47	.32 Factor C
15	Knows his airplane and equipment.	.35	---
20	Excellent in one of the following: a. Bombing b. Gunnery c. Instrument flying d. Aerology e. Navigation	.31	---

The loadings of items on this factor all of which pertain, directly, to the job of flying *per se*, appear to warrant labelling it, tentatively "Skill and interest in flying." It is to be noted that only one of the items carries a loading on another factor. Little comparability is shown with any of the Pilots' clusters, but considerable overlap with Psychologists' Cluster 5 (pertaining to "minimal skills") is evident. Of the items included on the checklists this cluster contained free response categories analogous to both 19 and 22. The cluster also contained a category analogous to Item 25, which did not have a High counterpart among the items on the High checklist.

Factor H: Teamwork

Item	Description	Loadings on: Factor H	Other Factors
9	A teamworker. You can count on him and he will count on you.	.48	---
1	He feels responsible for the safety of all personnel flying in combat with him.	.39	.33 Factor E
14	Does not take foolish risks which endanger the lives of others.	.39	.32 Factor E

Although Items 1 and 14 also carry loadings on Factor E, "Leadership," their loadings on Factor H, in conjunction with the High loading on this factor of Item 9, warrants labelling the factor "Teamwork." This factor shows considerable comparability with Pilots' and Psychologists' Clusters 1, pertaining also to Teamwork. All the items loaded on this factor are included in the Psychologists' Cluster, and the two items included in the Pilots' cluster (9 and 14) are also loaded in Factor H.

Factor X: Residual, not interpreted

Item	Description	Loadings on: Factor X	Other Factors
6	Gets the word quickly and remembers well.	.34	.31 Factor B
18	Holds up well in tight spots.	.32	.35 Factor C; .34 Factor F

Factor X contained only two items with loadings of over .30, and none with loadings as high as .35. It was considered a residual factor, and was not interpreted.

Interpretation of Factors in the Low Group

As was the case with the analysis of data from the Highs, nine factors were yielded by the analysis on the Low group, eight of which were psychologically meaningful. They may tentatively be designated as follows:[10]

A. Temperamental unsociability (analogous to High Factor A, "Easy-going-Sociability" in a converse sense.)

B. Lack of practical intelligence (analogous in a converse sense to High Factor B, "Practical Intelligence).

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[10] In so far as possible, the respective Low factors have been given the same letter designation as the High factors to which they correspond. Assignment of letter designations to factors is, of course, wholly arbitrary.

C. Excitability, lack of coolheadedness (Analogous in a converse sense to High Factor C, "Coolness, Steadiness.")

D. Failure to take job seriously (Analogous to High Factor D "Seriousness, Conscientiousness, in a converse sense.)

E. Reaction to failure by mental mechanisms (This factor does not have an analogue among the High factors.)

F. Fear syndrome (Analogous, in a converse sense, to High Factor F, "Combat Aggressiveness.")

G. Lack of Job Skill (Analogous in a converse sense to High Factor G, "Skill and interest in flying.")

H. Foolhardy individualism (Analogous to High Factor H, "Teamwork", in the converse sense.)

The structure of these factors in terms of major loadings will be discussed below. Again, comparability between these factors and the clusters of free response categories made by pilots and psychologists will be noted.

Factor A: Temperamental unsociability. (Analogous to High Factor A, Easy-going sociability.)

Item	Description	Loadings on: Factor A	Other Factors
3*[11]	Temperamental, irritable, or quick-tempered on the ground.	.60	.32 Factor C
10*	Won't listen to criticism. Thinks his way is always right.	.55	.32 Factor E
17	Not a leader of men. Doesn't have the confidence and respect of others.	.50	---
11*	Keeps to himself; doesn't mix.	.49	---
25	Thinks he is a hot pilot	.31	.37 Factor E; -.27 Factor F
9	No sense of teamwork. Would leave you in the lurch in order to make a name for himself.	.30	.36 Factor E; .38 Factor H

Particularly with reference to Items 3, 10 and 11, which carry high loadings, this configuration of items appears related to "Temperamental unsociability," and appears to be the converse of High Factor A, "Easy-going,

[11] An asterisk following an item number in the presentation of Low factors indicates that the item appears in the corresponding "core factor" discussed later in this chapter.

Sociability." The inclusion of Item 17 in this factor may result from the connotation of "Doesn't have the confidence and respect of others" rather than primarily with the "Leadership" function. The inclusion of Items 25 and 9, with relatively low loadings, represent an interesting commentory on the possible structure of this behavior characteristic. This factor does not appear to be represented by a counterpart among the Pilots' or the Psychologists' clusters.

<u>Factor B</u>: <u>Lack of practical intelligence</u>.
(Analogous to High Factor B, Practical intelligence.)

		Loadings on:	
<u>Item</u>	<u>Description</u>	<u>Factor B</u>	<u>Other Factors</u>
12*	Poor at sizing up tactical situations.	.54	---
5*	Dopes off. Flies with his head "in the cockpit."	.48	---
24	Dilbert. Always pulling some dumb stunt.	.44	---
6*	Just doesn't get the word. Learns slowly and forgets fast.	.42	---
22	Just can't fly well enough.	.35	.40 Factor G
8*	Can't make up his mind quickly. Doesn't think fast enough to keep up with his airplane.	.31	---

This is a relatively clear factor, only one item carrying a loading in another factor, and can be identified with "Lack of practical Intelligence," although Items 24 and 22 appear not so clearly related to this behavior complex as in other four items.

This factor appears analogous, in a converse sense, to High Factor B, "Practical Intelligence." The factor also appears relatively comparable in structure to the Psychologists' Cluster 3, labelled "Practical Intelligence" and to the Pilots' Cluster 4 ("Intellectually and perceptually inadequate.") Only one item of the five carrying loadings of greater than .30 in the Factor analysis was not represented by an analogous free response category in the Psychologists' or in the Pilots' clusters.

<u>Factor C</u>: <u>Excitability, lack of coolheadedness</u>.
(Analogous to High Factor C, Coolness, Steadiness).

		Loadings on:	
<u>Item</u>	<u>Description</u>	<u>Factor C</u>	<u>Other Factors</u>
18*	Likely to blow up when the going gets tough.	.43	.37 Factor F
23	Always has excuses for anything done wrong.	.37	.52 Factor E
13*	Nervous and tense even on the ground.	.34	.35 Factor F; .42 Factor G
3*	Temperamental, irritable, or quick-tempered on the ground.	.32	.60 Factor A

The items constituting this factor appear to be related to "Excitability, lack of coolheadedness," the factor being somewhat analogous, in a converse sense, to High Factor C "Coolness, Steadiness," although, as will be noted in the discussion of "Core" factors, the comparability is not as complete as in the case of certain other factors, e.g., Factor B. Factor C for the Low group is somewhat comparable to the Psychologists' Cluster 2 "Emotional Stability" and to the Pilots' Cluster 3, "Emotionally inadequate." Both of these clusters contained the free response analogues of Items 18 and 13. The Psychologists' Cluster also contained one other free response category (analogous to Item 7), the Pilots' cluster also containing two other categories, analogous to Items 4 and 11.

Factor D: Lack of Conscientiousness. (Analogous to High Factor D, Seriousness, conscientiousness.)

Item	Description	Loadings on: Factor D	Other Factors
2*	Hasn't grown up. Doesn't take his work seriously.	.61	.31 Factor H
21*	Irresponsible, lazy, or careless. Doesn't carry through his duties promptly and properly	.59	---
15*	Doesn't know his airplane or equipment.	.42	---

The items constituting this factor appear clearly identifiable with "Lack of conscientiousness," or "Failure to take job seriously," and represents the counterpart of Factor D in the High group, "Conscientiousness." Only one item carries a loading, and a low one, on another factor.

This low factor is not particularly comparable in structure to any of either the Psychologists' or Pilots' clusters, although there is perhaps some slight resemblance to Pilots' Cluster 6, "Immature." The free response analogues of both Items 2 and 21 were included in the Pilots' cluster, the cluster however, containing five other categories, giving the cluster a connotation somewhat different than that of this Low factor.[12]

Factor E: Reaction to failure by mental mechanisms. (This factor does not have any analogue among the High factors.)

Item	Description	Loadings on: Factor E	Other Factors
26	Lies about his experience and cheats on his score.	.78	---
23	Always has excuses for anything done wrong.	.52	.37 Factor C

---

[12]The correspondence of Factor D to the Pilots' Cluster 6 is markedly less than the correspondence of Factor E with this cluster, as noted below.

Factor E (Continued)

Item	Description	Loadings on: Factor E	Other Factors
1	Too worried about his own safety. Would save his neck even at the expense of his squadron mates.	.45	.59 Factor F
7	Avoids or evades going on combat missions.	.37	.57 Factor F
25	Thinks he is a hot pilot.	.37	.31 Factor A; -.27 Factor F
9	No sense of teamwork. Would leave you in the lurch in order to make a name for himself.	.36	.30 Factor A; .38 Factor H
10	Won't listen to criticism. Thinks his way is always right.	.32	.55 Factor A

Four of the seven items constituting this factor (Items 26, 23, 25 and 10) can be considered quite clearly to represent mental mechanisms in terms of which an individual reacts to failure, or, perhaps more specifically, elements of observable intra-personal behavior chiefly compensatory in nature, associated with reaction to failure. The remaining three items (1, 7 and 9) do not so clearly carry this compensatory connotation, although they could be considered associated with general emotional and constitutional inadequacy. Nevertheless, the item structure of the factor would appear to warrant the label "Reaction to failure by mental mechanisms," although it might also be considered to refer to general constitutional and emotional inadequacy.

This factor does not have an analogue among the High factors. The two items carrying highest loadings (numbers 26 and 23) had no counterpart in the Checklist A used for indicating reason for nomination of High nominees, and Item 25, also having no High counterpart, carried a loading (of .37) on this factor. It is these three items that give the factor much of its identification with compensatory behavior. The appearance of this factor in the Low analysis might be attributed to the differences between the checklists. On the other hand it may represent a characteristic peculiar to Low nominees.

Factor E appeared quite comparable to the Pilots' Cluster 6 of free response categories, which was labelled "Immature." Four of the items in this factor (numbers 10, 23, 25 and 26) appeared, in terms of their free response analogues, in the Pilots' cluster. Three items (1, 7 and 9) had no analogues, in the Pilots' cluster, and three free response categories (2, 14, 21) had no analogues in Factor E. Thus the connotations of the Pilots' Cluster 6, and of Factor E are not identical. There is little indication of correspondence with any of the Psychologists' Clusters.

Factor F: Fear syndrome (Analogous to High Factor F, Combat aggressiveness.)

Item	Description	Loadings on: Factor F	Other Factors
1	Too worried about his own safety. Would save his own neck even at the expense of his squadron mates	.59	.45 Factor E
7*	Avoids or evades going on combat missions.	.57	.37 Factor E
19	Lacks desire to fly.	.53	---
18*	Likely to blow up when the going gets tough.	.37	.43 Factor C
13	Nervous and tense even on the ground.	.35	.34 Factor C; .42 Factor G

Items 1, 7, 18 and 13, carrying loadings on this factor appear associated with fear reactions and lead to designating the factor "Fear Syndrome." All of the items carry loadings on other factors.

This factor appears relatively comparable in a converse sense to High Factor F, Combat Aggressiveness, although the High factor was characterized by loadings on only two items, numbers 7 and 18, both of which carry loadings on the Low Factor F.

This factor bears some resemblance to Pilots' Cluster 2 of free response categories which was labelled "Lacking in motivation." This cluster contained only two categories, the analogues of Items 7 and 19, both of which carried loadings in Factor F. The inclusion of the other items in the factor structure yields a slightly different connotation, however. None of the psychologists' clusters resembled this factor.

Factor G: Lack of job skill. (Analogous to High Factor G, Skill and interest in flying.)

Item	Description	Loadings on: Factor G	Other Factors
13	Nervous and tense even on the ground.	.42	.34 Factor C; .35 Factor F
20*	Poor in one or more of the following: a. Bombing b. Gunnery c. Instrument flying d. Aerology e. Navigation	.[illegible]2	---
22*	Just can't fly well enough	.[illegible]0	.35 Factor [illegible]

The three items, all carrying loadings of about .40 on this factor appear associated with "Lack of job skill." At first consideration, the inclusion of Item 13 ("Nervous and tense even on the ground") may appear somewhat

anomalous. However, lack of job skill may well represent a primary causative factor in nervousness and tenseness "even on ground." This factor can be considered relatively comparable, in a converse sense, to Factor G in the High analysis, "Skill and interest in flying." None of either the Pilots' or Psychologists' clusters were at all comparable to this factor.

<u>Factor H:</u> <u>Foolhardy individualism.</u>
(Analogous to High Factor E, Teamwork.)

Item	Description	Loadings on: Factor H	Other Factors
14*	Deliberately takes foolish risks in his airplane, unnecessarily endangering the lives of others.	.67	---
9*	No sense of teamwork. Would leave you in the lurch in order to make a name for himself.	.38	.30 Factor A; .36 Factor E
16	Doesn't plan ahead but relies on luck. Acts first and thinks second.	.35	---
2	Hasn't grown up. Doesn't take his work seriously.	.31	.61 Factor D

Particularly because of the high loadings of Item 14 on this factor, the designation "Foolhardy individualism" appears warranted. Items 9, 16 and 2 appear associated with individualistic behavior, in this context, although Item 2 also carries a high loading on Factor D, "Lack of conscientiousness." This factor can be considered comparable, in a converse sense, to Factor E in the High analysis, designated "Teamwork". Factor H bears considerable resemblance to Pilots' and Psychologists' Clusters 1. The Pilots' cluster contained only the free response equivalents of Items 9 and 14, both of which items carried loadings on the Low factor. The Psychologists' cluster contained the free response category equivalents of these two items, as well as four others, but did not include Items 16 and 2, which carried loadings on the Low factor.

<u>Factor K:</u> <u>Residual, not interpreted.</u>

(No loadings as great as .30)

Factor K, carrying no loadings as great as .30 was considered a residual factor and was not interpreted.

<u>General Considerations Relative to High and Low Analyses</u>

It is evident that the configuration and structure of the factors derived on the basis of the High and Low analyses is suggestive and provocative. Before turning to a detailed comparison of the High and Low factor structure a brief examination of certain points relative to the individual analyses is in order.

<u>Intercorrelations among Factors</u>. The intercorrelations among the High factors are presented, as noted previously, in Table 7.07 and among the Low factors in Table 7.08. As mentioned earlier in this chapter, the fact that the correlations among the High factors are in general greater than among the Low factors is in line with expectation, based on the previously noted fact that reasons for nomination for Low tended to be more specific to individual officers than was the case with High nominations, and that conversely, nominations for High tended to be made for more general reasons.

With reference to the High analysis it is of interest that Factor B, "Practical Intelligence" had the largest number of siseable correlations (above .40) with other factors, being particularly highly correlated (.60) with Factor D, "Seriousness, Conscientiousness" and also correlated about .40 with Factors E, F and H. The fact that Factors D and H ("Seriousness and Conscientiousness" and "Teamwork") were also highly correlated (.61) seems altogether reasonable. The relatively high coefficient (.60) between G and F ("Skill.." and "Aggressiveness") perhaps reflects the importance of skill as a corrolary of aggressiveness in operational flying.

On the other hand Factor C (Coolness, steadiness) showed no correlations greater than .30 with any other factor. It is also noteworthy that for all practical purposes a zero correlation was evident between Factor E (Leadership) and Factors F and G, respectively (Combat aggressiveness, and Skill and interest in flying). This finding tends to bear out the statements made in interviews that certain men considered good leaders were not always the most skillful, or the most aggressive pilots.

With reference to the analysis of the data for Lows, while the factor configuration meets the criterion of simple structure, about half of the correlations between factors were negative, none of them being markedly high, although three of .30 or greater (between .30 and .39) were found. Due to the more orthogonal structure of the factor configuration, and the fact that Low nominees tended to be tagged as such for more specific reasons, the presence of negative correlations is not surprising. For example the negative (-.30) coefficient between Factors F and H ("Fear syndrome" and "Foolhardy individualism") is altogether reasonable. Similarly the rather high negative coefficient (-.29) between Factors F and C ("Fear syndrome" and "Excitability, lack of coolheadedness") makes sense. Although lack of coolheadedness, or rash and impulsive behavior, might conceivably result from compensatory behavior based on fear, certainly the tendency for evidence of impulsiveness to be somewhat negatively related to evidence of fear is more reasonable. On the other hand Factors H and C (Foolhardy individualism and Excitability) do not appear to be markedly related. (r = +.20). It is of interest that the factor having the fewest number of negative coefficients is Factor D ("Failure to take job seriously"), correlating negatively (-.16) only with Factor C (Excitability, lack of coolheadedness), and being in fact practically orthogonal to the other factors.

Certainly, it cannot be said that the low negative correlations between certain of these factors vitiate the meaningfulness of the configurations. In fact, the negative correlations would appear to support the reasonable and common sense nature of the factor configuration, and to suggest that different Low nominees were, in fact, nominated for widely divergent reasons.

Certain of the positive correlations among Low factors also are of interest. Factor G correlated +.43 with Factor B, and +.33 with Factor F. This relationship of "Lack of Job Skill" with "Lack of Practical Intelligence" and with the "Fear syndrome" is suggestive. Factor D correlated about +.30 with both Factors B and E. The relationship between "Failure to take job seriously" (or lack of conscientiousness) with "Lack of Practical Intelligence" and the "Reaction to failure" factor similarly is of interest.

Theoretical Implications of Factor Correlations. At least superficially, certain implications of the results of these factor analyses for personality theory are relatively obvious. On the basis of the correlations among factors it might be said that personality characteristics of High nominees are related, in that if an officer is possessed of certain characteristics he probably also possesses certain others. This could be taken to indicate a degree of integration characteristic of the personalities of High nominees. On the other hand it might be said that Low nominees on the whole tend to possess only a few of the characteristics which lead to failure to be accepted as combat pilots. Furthermore the fact that among Low nominees the traits characterised by the "Fear syndrome" and by "Excitability" or "Foolhardiness" are negatively correlated is of considerable theoretical import.

It is also of interest that for High nominees the configuration of reasons for nomination labelled "Practical judgment" correlated positively, and greater than .30 with 5 of the 7 other configurations, whereas among the Low nominees the counterpart correlated positively ($r > .30$) only with the Factor called "Failure to take job seriously" and "Lack of job skill"; and in fact was correlated somewhat negatively with four of the other five Factors. "Combat aggressiveness," and "Job Skill" (and their counterparts in the Low analysis) correlated positively in both High and Low analyses. On the other hand the "Fear syndrome" correlated negatively (-.30) with "Foolhardy individualism" in the Low analysis, whereas in the High analysis the counterparts of these two factors were related positively, although not so markedly ($r = .26$). If nothing more, findings of this nature may represent sources of valuable hypotheses as to the possible personality structure of High and Low nominees.

Such generalizations based on the assumption that the factors represent personality traits may well be warranted. On the other hand it should be recognized that the factor structure represents configurations of descriptions made by pilots of their reasons for nominating their mates High or

Low. While the factors yielded by the analysis of reasons for nomination may in fact show a one-to-one relationship with the personality characteristics or traits underlying the behavior of the nominees, nevertheless they cannot be considered to do so without further exploration of the problem. In other words, the basic data of these analyses come from verbal descriptions chosen by the <u>respondents</u>, rather than from clinical analyses of the <u>nominees</u>. Among the implications of this situation is the fact that the factor structure may have been "improved" somewhat through the respondents' reporting reasons for nomination in terms of their particular stereotypes regarding good and poor combat performance. Definitive interpretation can be made only in recognition of these possible limitations.

Such limitations are, of course, implicit in many factor studies of personality. It seems fair to state however that the <u>possibility</u> that aspects of basic personality structure are reflected by the results of the factor analysis is of marked importance, and should be provocative of additional research in this area. As a matter of terminology the factors may be considered to represent "observed behavior syndromes."

<u>Comparison of High and Low Factors</u>

Comparability between the factors yielded in the High and Low analyses, even though the two analyses were performed independently and without reference to each other, has been brought out earlier in this chapter. Seven of the factors in each analysis had readily identifiable counterparts in the other analysis. One factor in the High analysis (pertaining to Leadership) had no counterpart in the Low analysis, and one factor in the Low analysis (pertaining to Reactions to failure) had no counterpart in the High analysis.

Moreover, the structures of paired factors were not, in general, completely identical. That is, while the structure of paired factors was represented by loadings on the A and B list counterparts for most of items defining the factors, certain items appeared only in the High member of certain paired factors, whereas other items appeared only in the Low member.

<u>Reasons for Lack of Comparability</u>. Before examining the implications of difference in structure of the paired factors, it is desirable to consider briefly possible reasons for lack of comparability. One major cause would seem to be that in terms of the questions used to elicit nominations, the behavior called for in High nominees was not the opposite of the behavior called for in Low nominees. Thus the configurations of reasons for nomination High and Low could not be expected to be diametrically opposed.

Men nominated for High presumably represented pilots on whom the respondent would be glad to fly wing. Men nominated for Low presumably represented men whom the respondent would not want flying wing on him. Thus High nominees represented men the respondent <u>[illegible]</u>; Low nominees, men whom the respondent <u>[illegible]</u>. While the purpose of this distinction was to provide a wide difference between High and Low groups, it undoubtedly prevented more direct comparability between High and Low factors through the influence of this distinction on the [illegible] of reasons for nomination.

In these terms the fact that a "Leadership" factor appeared only in the High analysis is altogether reasonable, since the respondents could not in general be expected to nominate a man as a subordinate, for reasons of lack of leadership ability. Similarly, the fact that a "reaction to failure" factor appeared only in the Low analysis may, as noted previously, be due to a different behavior (or observed behavior) structure among Low nominees, but also may have resulted in part from the fact that the two items carrying heaviest loadings on this Low factor had no counterparts on the High or A checklist, and that another item appearing only in the Low checklist also carried a loading on this factor.

A number of other conditions undoubtedly contributed to the fact that the item-structures of the paired factors were not completely identical. For one thing the High and Low counterparts of certain items in all probability did not describe "opposite" behavior patterns, and moreover in certain cases items were ambiguous or double-barreled. For example, Item 2 on the B list read "Hasn't grown up. Doesn't take his job seriously" and might be considered a poor item because a high relationship between immaturity and lack of conscientiousness is implied. Also, with respect to Item 1, "Feels responsible for others" may well not be directly opposed to "Too worried about own safety," inasmuch as lack of responsibility could be dictated by other considerations, such as impulsiveness.

Another point which may have affected the comparability between High and Low factors, and to some degree the factor configurations themselves, is the fact that the samples in terms of which the analyses were conducted were not completely homogeneous. In particular the variable rank was not controlled. As indicated in Chapter V there was some variation, although not much, in incidence of reason for nomination in terms of rank, and the effect of rank on incidence of use of specific reasons for nomination was not the same in the High and Low analyses respectively. This situation may have introduced some lack of comparability between High and Low factors, and may have distorted somewhat the factor configurations from the High and Low analyses. The general orderliness of the configurations, however, suggests that the effect of lack of homogeneity was not too great.

In view of these facts, the evident comparability between the results of the High and Low analyses is striking, and suggests the desirability of somewhat more detailed consideration of the factor structure of the paired factors. A major purpose of such detailed consideration is the establishment of what might be termed "core factors", i.e., paired factors representing continua in terms of which certain basic characteristics of the observed combat behavior of both good and poor combat pilots could be defined.

Examination of "Core Factors"

Detailed comparison of the High and Low factors suggested that seven "core factors" could be set up, which would represent, respectively, seven

continua in terms of which behavior of both good and poor combat pilots could be expressed.[13] These seven "core factors" can be termed, respectively:

A. Sociability
B. Practical Intelligence
C. Coolheadedness
D. Conscientiousness
F. Aggressiveness (vs. Fear)
G. Skill in flying
H. Teamwork (vs. foolhardy individualism)

The structure of the "Core Factors" will be presented and discussed below. In the presentation of these factors, the items which appeared on both High and Low factors will be listed first, followed by the items which appeared on either the High or Low factor, but not on both. Moreover, certain hypotheses suggested by the comparison of High and Low members of the paired factors will be indicated. It should be emphasized that these suggestions will be presented not as firm conclusions to be drawn from the analyses, but rather as hypotheses possessing particular heuristic import.

"Core Factor A": Sociability[14]

List A	High	Low	List B
3 Even-tempered and well-balanced on the ground.	.59	.60	3 Temperamental, irritable, or quick-tempered on the ground.
11 Gets along well with squadron mates.	.52	.49	11 Keeps to himself; doesn't mix.
10 Welcomes suggestions and reacts well to criticisms.	.36	.55	10 Won't listen to criticism. Thinks his way is always right.

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[13]The criterion of matching was that a maximum number of items, and at least two or three, should have loadings of above .30 on both High and Low members of the pair of factors. As a guide in checking the matching, and in observing the differential placement of the items on the High and Low factors, the factor loadings of all items on each High factor were plotted against the factor loadings on the corresponding Low factors. In the discussion of the seven "core factors" the items carrying loadings of .20 or more on each of the pair of factors will be presented.

[14]The items will be identified in terms of the designation given the High member of the pair of factors.

"Core Factor A": Sociability - Continued

	List A	High	Low		List B
13	Easy-going and not easily excited.	.58	.12	13	Nervous and tense even on the ground.
17	A real leader. Has confidence of others.	.16	.50	17	Not a leader. Doesn't have confidence of others.
9	A team worker. Can be counted on	.12	.30	9	No sense of teamwork. Would leave you in the lurch in order to make a name for himself.

This "Core Factor" can be identified with "Sociability." Items 3, 10 and 11 have generally similar factor loadings on both the High and Low factors and clearly refer to the general interpersonal social behavior of the pilots. Three items appear on one member of the pair of factors but not on the other. With reference to the lack of comparability in terms of these three items the following hypotheses might tentatively be suggested:

1. The appearance of Item 13 on the High factor but not the Low may result from the fact that the description on the High checklist (List A) could refer either to social behavior on the ground or to behavior in the air, and in any case the corresponding item on the Low checklist is not a very good opposite to the High item. Moreover it is conceivable that a pilot could be a reasonably good mixer and yet "nervous and tense even on the ground."

2. Item 17, pertaining to Leadership, appears only on the Low factor. It does carry a loading, however, on Factor K, "Leadership," which was unique to the High group. Appearance of this item on the Low factor may be explained by the double-barrelled nature of the Checklist B phraseology, (i.e., reference both to leadership and lack of confidence), although it might also be inferred that lack of leadership is a characteristic of persons characterized by "Temperamental unsociability" but that leadership is not *necessarily* one of the elements of officers who fit into the "Easy-going sociability" category.

"Core Factor B": Practical Intelligence

	List A	High	Low		List B
5	Alert. Knows what's going on every minute in the air.	.38	.43	5	Dopes off. Flies with his head "in the cockpit."
12	Accurately sizes up tactical situations.	.33	.54	12	Poor at sizing up tactical situations.
6	Gets the work quickly and remembers well.	.31	.42	6	Just doesn't get the word. Learns slowly and forgets fast.

"Core Factor B": Practical Intelligence - Continued

List A	High	Low	List B
8 Thinks fast enough to reach wise decisions quickly.	.33	.31	8 Can't make up his mind quickly; doesn't think fast enough to keep up with his airplane.
16 Always thinks ahead and figures things out. Has a plan for any situation that is likely to come up.	.50	.22	16 Doesn't plan ahead but relies on luck. Acts first and thinks second.
22 Excellent plane-handler. Gets the most out of his airplane.	.05	.35	22 Just can't fly well enough.
4 Steady and reliable in the air.	.07	.25	4 Erratic, unpredictable in the air. You can never tell what he will do next.

Items 5, 12, 6, 8 and 16 all carry loadings above .20 on both factors, and appear to refer to the mental alertness or practical intelligence of the pilots in meeting situations, generally in the air, e.g., in planning the course of a mission and in coming to grips with the enemy. Items 22 and 4 do not appear on the High factor but carry loadings (relatively low loadings) on the Low factor. Neither is dependent on intellectual traits from a logical point of view. In this regard:

1. It is of interest to note that lack of flying skill is associated with the items making up the factor "Lack of practical intelligence," although the converse is not true, i.e., particular ability as a plane handler is not necessarily associated with "Practical intelligence."

2. Item 4 is one of the most frequently mentioned traits of Low pilots, and appears on several factors but in no case with a particularly high loading. It appears to sum up much of what pilots think is particularly bad about Low nominees. A possible explanation for its appearance on the Low factor B is that pilots who lack practical intelligence are likely to do the wrong thing and in effect behave "unpredictably."

"Core Factor C": Coolheadedness

List A	High	Low	List B
18 Holds up well in tight spots.	.3[illegible]	.43	18 Likely to blow up when the going gets tough.
13 Easy-going and not easily excited.	.2[illegible]	.34	13 Nervous and tense even on the ground.
3 Even-tempered and well-balanced on the ground.	.19	.32	3 Temperamental, irritable, or quick-tempered on the ground.

. . .

"Core Factor C": Coolheadedness - Continued

List A	High	Low	List B
4 Steady and reliable in the air	.49	.15	4 Erratic, unpredictable in the air. You can never tell what he will do next.
8 Thinks fast enough to reach wise decisions quickly.	.37	.06	8 Can't make up his mind quickly; doesn't think fast enough to keep up with his airplane.
22 Excellent plane handler. Gets the most out of his airplane.	.32	-.04	22 Just can't fly well enough.
10 Welcomes suggestions and reacts well to criticisms.	.02	.26	10 Won't listen to criticism. Thinks his way is always right.

Of all the pairs of factors matched, the pair making up Core Factor C shows the poorest correspondence. However, all of the items carrying loadings on either factor appear to be related to "Coolheadedness" or "Emotional Stability" in either the High or Low sense, or both. Items 18, 13 and 3 carried loadings on both factors. Items 4, 8 and 22 carried loadings only on the High factor, Item 10 only on the Low. This lack of correspondence is probably due to differences in the reaction of the respondents to the behavior of High and Low nominees, respectively, in regard to "Coolheadedness," which may well be due to differences in the definition of High and Low nominees, as discussed previously. That is the qualities of being "steady and reliable," "thinking fast," and "an excellent plane handler" might be more important considerations, in regard to "coolheadedness" among pilots on whom one would like to fly wing, than would the converse of these qualities among pilots whom one would not like to fly wing on. At any rate, certain differences in the connotation of "coolheadedness" as it applies to High and Low nominees are suggested.

Moreover, Factor C in the Low group may refer more to behavior on the ground than is the case with the High factor. This might also explain the discrepancies.

"Core Factor D": Conscientiousness

List A	High	Low	List B
2 Takes his job seriously	.52	.61	2 Hasn't grown up. Doesn't take his job seriously.
21 Carries out his responsibilities promptly and properly.	.47	.59	21 Irresponsible, lazy, or careless. Doesn't carry through his duties promptly and properly.
15 Knows his airplane and its equipment.	.20	.42	15 Doesn't know his airplane or equipment.
19 Loves to fly.	.24	.27	19 Lacks desire to fly.

"Core Factor D": Conscientiousness - Continued

List A	High	Low	List B
16 Always thinks ahead and figures things out. Has plan for any situation that is likely to come up.	.30	.2[illegible]	16 Doesn't plan ahead but relies on luck. Acts first and thinks second.
6 Gets the word quickly and remembers well.	.15	.20	6 Just doesn't get the word, learns slowly and forgets fast.

The two items which form the core of this factor are Items 2 and 21; both of these refer to conscientiousness, on the positive side, and carelessness, on the negative side. Item 15 is probably associated with this common trait because knowledge of the airplane and its equipment requires considerable conscientious attention to detail, although the difference in magnitude of factor loadings of Item 15 on the two factors might suggest that failing to know one's plane and equipment is more heavily weighted in terms of Lack of Conscientiousness than is knowing one's plane and equipment in the positive connotation. Item 19, "desire to fly," has relatively low loadings both on the High factor and the Low factor; nevertheless, motivation for flying would be expected to be a necessary factor in taking seriously the job of being a combat aviator.

Items 16 and 6 appear (weakly) only on the Low factor. In the case of Item 16, this may be due to the implication of the phraseology that the individual "relies on luck," i.e., is careless.

"Core Factor E": Aggressiveness in Combat [illegible]

List A	High	Low	List B
7 Is aggressive. Presses home the attack.	.55	.57	7 [illegible] going on combat missions.
18 Holds up well in tight spots.	.34	.37	18 Likely to blow up when the going gets tough.
12 Accurately sizes up tactical situations.	.27	.24	12 Poor at sizing up tactical situations.
1 He feels responsible for the safety of all personnel flying in combat with him.	.0[illegible]	.[illegible]	1 [illegible] worried about his own safety. Would save his own neck even at the expense of his squadron mates.
19 Loves to fly.	-.05	.55	19 Lacks desire to fly.
13 Easy-going and not easily excited.	.06	.15	13 [illegible]
11 Gets along well with squadron mates; mixes well.	.[illegible]	.22	11 Keeps to himself [illegible]

For Items 7, 18 and 12 the factor loadings on the High and Low factors are surprisingly congruent. Items 7 and 18 quite clearly define the factor as referring to aggressiveness or to lack of fear. Item 12 has relatively weak loadings, and the relation to aggressiveness of good and poor behavior to which this trait refers is not immediately apparent. It might be suggested, however, that ability to size up tactical situations would engender aggressiveness, or that, at least in the eyes of the respondents, accurately sizing up the tactical situation was a necessary concommitant of aggressive behavior, whereas with reference to the Low officers the presence of fear precluded effective analysis of the situation.

Items 1, 19, 13 and 11 carried loadings only on the Low factor, the loading of Item 11 being weak, the others relatively strong. A number of explanations of these discrepancies might tentatively be suggested.

1. Item 1 in list B does not appear to be the exact opposite of its A list counterpart in this context. It is readily understandable how an aggressive pilot might not necessarily be concerned with the safety of others, while a pilot evidencing fear would be preoccupied with his own safety.

2. With reference to Item 19, "Lack of a desire to fly" may well be an integral part of the whole fear syndrome, whereas the sort of behavior associated with the person who "loves to fly" may well not be an element in aggressiveness.

3. The ambiguity of Item 13 has previously been noted, i.e., the phraseology on the Low checklist has reference almost exclusively to behavior on the ground. Moreover, nervousness and tenseness might logically be considered a component of the fear syndrome, whereas there would seem little logical reason to label an aggressive individual necessarily as "easy going and not easily excited."

4. Item 11 appears weakly on the Low factor. It might be suggested that one reason for "keeping to oneself" is the feeling of fear engendered by the combat situation and the resulting tendencies to withdraw socially. It is interesting, however, that, in terms of the suggestions yielded by this analysis, aggressiveness is not necessarily associated with the behavior characteristic of the "good mixer."

Score Factor 3's Skill in Flying

List A	High	Low	List B
22 Excellent plane-handler. Gets the most out of his airplane.	.47	.4[illegible]	22 Just can't fly well enough

"Core Factor 3": Skill in Flying - Continued

List A	High	Low	List B
20 Excellent in one or more of the following: a Bombing b Gunnery c. Instrument flying d. Aerology e Navigation	.21	.4[illegible]	20 Poor in one or more of the following: a. Bombing b. Gunnery c. Instrument flying d. Aerology e. Navigation
15 Knows his airplane and its equipment.	.35	.23	15 Doesn't know his airplane or its equipment.
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19 Loves to fly	.47	.05	19 Lacks desire to fly.
5 Alert. Knows what's going on every minute in the air	.20	.08	5 Dopes off. Flies with his head "in the cockpit."
13 Easy-going and not easily excited.	-.07	.42	13 Nervous and tense even on the ground.
4 Steady and reliable in the air.	.17	.23	4 Erratic, unpredictable in the air. You can never tell what he will do next.
18 Holds up well in tight spots.	-.08	.26	18 Likely to blow up when the going gets tough.
8 Thinks fast enough to reach wise decisions quickly.	.06	.27	8 Can't make up his mind quickly. Doesn't think fast enough to keep up with his airplane.

The three items which are clearly common to both the High and Low factors (Items 22, 20 and 15) are directly related to expertness in the job of flying, i.e., to technical skill and knowledge. Two items are loaded only on the High factor, four items are loaded only on the Low factor. The possible explanations of these discrepancies are suggestive of differences which may exist between good and poor combat pilots in terms of this characteristic.

1 The fact that Item 19 (Loves to fly) carried a high loading on the High factor but effectively a zero loading on the Low factor is not illogical. It would be expected that men expert in flying would enjoy flying while some persons lacking in skill might enjoy the activity whereas others might not. Certainly, by analogy, although skilled motorists usually appear to enjoy the activity, there are many who "love to drive" but who, in fact, drive with remarkable ineptness.

2 Item 5 has a low loading, and only on the High factor. Because of the magnitude of the loading even tentative generalizations probably are not warranted. It is of interest, however, that the characteristic "Dopes off" is not loaded on the "Lack of skill" factor. This item carries no very high loadings on any Low factor, the highest being a loading of .31 on Factor E, "Lack of Practical Intelligence."

3. Item 13 carried a relatively high loading on the Low factor but not on the High, a situation which also prevailed with reference to Core Factor F (Aggressiveness vs. Fear). The same type of explanation might tentatively be suggested, i.e., "nervousness and tenseness" might well be associated with, or a result of, lack of skill. On the other hand "easy-going" characteristics would not logically appear, of necessity, to be associated with skill in flying.

4. Items 4, 18 and 8 carry relatively low loadings on the Low factor and negligible loadings on the High factor. Although these items represent behavior logically associated with lack of flying skill, it is evident that their converse need not necessarily be associated with "Skill in flying." With respect to Item 8 it might be suggested that inability to "think fast enough to keep up with the airplane" is sometimes due to lack of flying skill as well as to lack of "practical judgment." (Item 8 also carried loadings on Core Factor B.) With reference to Item 4, possibly pilots lacking in skill are likely to do the wrong thing and thus act "unpredictably." It is of particular interest that "Steadiness and reliability in the air" and "Holding up well in tight spots" are apparently not associated in the complex of items making up the "Skill in flying" factor in the High analysis.

"Core Factor H": Teamwork vs. Foolhardy Individualism.

List A	High	Low	List B
14 Does not take foolish risks which endanger the lives of others	.59	.67	14 Deliberately takes foolish risks in his airplane, unnecessarily endangering the lives of others.
9 A team-worker. You can count on him and he will count on you	.40	.38	9 No sense of teamwork. Would leave you in the lurch in order to make a name for himself.
4 Steady and reliable in the air.	.22	.25	4 Erratic, unpredictable in the air. You can never tell what he will do next.
1 He feels responsible for the safety of all personnel flying in combat with him.	.39	.03	1 Too worried about his own safety. Would save his own neck even at the expense of his squadron mates.
10 Welcomes suggestions and reacts well to criticisms	.27	.08	10 Won't listen to criticism. Thinks his way is always right.
11 Gets along well with squadron mates; mixes well.	.27	.08	11 Keeps to himself; doesn't mix.

"Core Factor H": Teamwork vs. Foolhardy Individualism - Continued

List A	High	Low	List B
16 Always thinks ahead and figures things out. Has a plan for any situation that is likely to come up.	.09	.35	16 Doesn't plan ahead but relies on luck. Acts first and thinks second.
2 Takes his job seriously.	-.01	.31	2 Hasn't grown up. Doesn't take his job seriously.
12 Accurately sizes up tactical situations.	-.02	.26	12 Poor at sizing up tactical situations.

The items which are common to the High and Low factors (Items 14, 9 and 4) unequivocally define an observed characteristic which differentiates good and poor combat aviators, namely the extent to which the pilot works with his associates as a combat team. These items rank high in judged importance (see Table 5.6) particularly with respect to List B.

Three items carried loadings only in the High analysis; three others carried loadings only in the Low. In reference to these discrepancies certain interpretations might be suggested.

1. As noted previously, Item 1 is ambiguous; the A list statement implying a positive thoughtfulness on the part of the pilot for his associates, whereas the B list statement carries the implication of fear, rather than mere lack of consideration of the safety of one's mates.

2. The appearance of Items 10 and 11 on the High Factor (and their non-appearance on the Low factor) might suggest that good teamwork in the air engenders good social relations on the ground, but that poor teamwork in the air has no necessary relation to sociability. This result seems somewhat contrary to expectations in view of the extremely critical attitude of the pilots towards poor teamworkers.

3. No ready explanation is at hand for the appearance of Items 16, 2 and 12 on the Low factor only. The situation may be confused by the fact that Item 2, and to some extent Item 16, are doublebarreled. These items may suggest elements of behavior in terms of which "Foolhardy individualism" does not represent the opposite of "Teamwork." Moreover, the difference in the High and Low samples, i.e., the fact that Lows were predominately of lower rank, may account for these discrepancies. Items 16 and 2, at least, have something of a connotation of immaturity.

Relative Importance of the "Core Factors"

The question of which of the "core factors" is most important or critical to success might well be raised. Little direct empirical evidence is at hand except the judgments of the pilots themselves as to the relative importance of the various items in the checklists. By averaging the importance ratings given the items (see Table 5.6) it is possible to arrange the core factors in order in terms of the judged importance of the items by which they are constituted. The rank order of the factors is almost identical whether the List A items or the List B items which appear on these core factors are used. The following table gives the rank order of the "core factors" in terms of judged importance. In addition, the two factors which were found to be unique to the High and Low groups, respectively, have been inserted in their proper positions relative to the other factors:

Factor	Mean Importance Rank, List A	Mean Importance Rank, List B
E. (High only) Leadership and Responsibility	4.0	--
H. Teamwork	6.3	3.3
B. Practical Intelligence	7.2	10.8
F. Combat Aggressiveness	10.6	10.0
G. Flying Skill	14.3	12.0
E. (Low only) Reaction to Failure	--	14.0
D. Conscientiousness	15.0	16.0
C. Coolheadedness	16.0	17.3
A. Sociability	19.6	22.0

As will be seen by inspection of Table 5.6, the ranks in List A are for 22 items, while those in List B are for 25 items. No adjustment has been made to make the ranks comparable, since the relative position of the factors in terms of judged importance is the principal consideration.

Considering the "Core Factors," it is of interest that the items constituting the "Teamwork," "Practical Intelligence" and "Combat Aggressiveness" were judged most important; whereas the items constituting "Conscientiousness," "Coolheadedness" and "Sociability" were judged least important. In these terms "Flying Skill" is of about "medium" importance. It is also significant that among High subjects, the most important factor, in these terms, is "Leadership and Responsibility," which in this analysis had no Low counterpart, possibly for reasons related to the manner in which nominations were obtained. Moreover, it is of interest that Factor A, which might be termed the "Good Joe" factor, ranked as least important.[15]

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[15] It also might be noted that some factors, although differing markedly in rank of importance, nevertheless correlated to a marked degree. For example, Factor D (Conscientiousness) correlated with Factors B and H, respectively, in the neighborhood of .60. However, Factor D was ranked among the least important; Factors B and H among the most important.

Conclusions

These findings with reference to the judged importance of factors give further emphasis to the considerations brought out earlier in this chapter in regard to the importance, in Naval aviation, of teamwork, practical intelligence, and aggressiveness, and, particularly with respect to High nominees, leadership and responsibility.

It is extremely difficult, of course, to obtain "outside" measures of the validity of "traits" or observed characteristics as defined by factor analysis. A number of considerations, however, attest to the logical reasonableness and rationality of the two analyses discussed in this chapter. In the first place, of course, the requirements of simple structure were met. Second, the correlations among the factors, even the moderately high negative relationships between certain Low factors, were for the most part subject to ready, and logical explanation.

Third, the considerable correspondence evident between the mathematically defined factor structure, and the clusters of free response categories established authoritatively by groups of psychologists, and pilots, respectively, lends considerable support to the logical validity of the results of the factor analysis. One to one relationships between factors and clusters were, of course, not found. However, the checklist items were not identical, in phraseology, to the definitions of categories. For that matter there were not even the same number of categories as items. Moreover, the categories represented classifications of free-response data, whereas reason-for-nomination data subjected to factor analysis was obtained by checklist procedures. In view of these differences, the degree of correspondence can be considered quite adequate.

It cannot be stated, unequivocally, that the factor structure is representative of configurations of behavior traits of good and poor Naval aviators. Nevertheless, on the basis of the factors themselves, and on the basis of the correlations among factors which have been discussed previously, a number of suggestive hypotheses have been posited.

In general, it is evident that the results of the factor analyses of data from High and Low subjects presents a reasonable picture of the observed characteristics of combat pilots, and an informative and suggestive one. It is also noteworthy that a measure of the importance of the obtained factors gives evidence of the prepotent position of characteristics associated with leadership, teamwork, practical intelligence, and aggressiveness.

IMPLICATIONS FOR FUTURE RESEARCH

The results of the factor analyses have a number of important implications for future research.

Selection Test Validation and Development

Difficulties of Predicting Reason for Nomination. As noted in the previous chapter, on prediction analysis, one of the major difficulties in at-

tempting to predict reason for nomination was that there was an insufficient number of subjects, homogeneous in terms of rank and specialty, nominated for specific reasons to make possible definitive determination of efficiency of prediction. A related consideration is that nominations for specific reasons are in general not markedly reliable. This unreliability of the criterion would serve further to attenuate the test-criterion relationships. Through use of the results of the factor analyses a number of these difficulties can be overcome, as discussed below.

Prediction of Reason for Nomination Factors. Through further analysis of the present data it would be possible to determine the degree to which the selection tests predict the several "observed behavior syndromes" represented by the factors. For example, the reason for nomination configurations which the "Core Factors" represent could be utilized in establishing criterion groups. Such utilization of these factors may well offset two of the inadequacies which beset attempts to predict individual reasons for nomination, previously discussed. First, prediction of configurations of reason for nomination would provide a larger N, the number of cases in each factor category being larger than the number of cases in terms of single reasons for nomination. Second, placement of a nominee in terms of a configuration of factors may be considered more reliable than placement in terms of a single reason for nomination.

In this connection, development of a "Core Factor Score" for each nominee might be suggested. That is, as a function of the factor loadings on the respective factors, each item "reason for nomination" could be assigned a factor score on each factor. (If the item carried no loading on certain factors the score of the item in terms of those factors would of course be zero.) Each High nominee would then be assigned a score on each of the seven High Core Factors, in terms of the reasons for which he was nominated. Similarly each Low nominee would be assigned a score on each of the Low Core Factors. By this means studies of the degree to which the selection tests predicted High and Low nomination in terms of the various "observed behavior syndromes" might be considerably facilitated.[16]

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[16]Development and use in research of such factor scores would obviously involve resolving a number of difficulties which cannot be discussed in detail here. For one thing, while a continuous distribution of scores would be available, only the tails of the hypothetical complete distribution would be represented, since reason for nomination data obviously would not be at hand for non-nominated officers.

This problem might be approached by estimating the proportion of non-nominated pilots in relation to the number of pilots on whom nomination data were available, and introducing a correction for wide-spread categories. Such a procedure, however, would appear to involve at least a tacit assumption that non-nominated pilots would be represented by zero scores on all factors. This might not be justified, since a person nominated for High might also receive zero scores on certain factors, and the assumption that he was equivalent, in terms of the factors on which he received a zero score, to a person who was not nominated at all, might be questioned.

Reasonable solutions to these, and similar problems, undoubtedly could be reached, however.

Test Construction. The results of the factor analysis may also have implications for the development of tests to predict combat efficiency. Assuming that the factors as isolated represent in fact fundamental behavior traits, or personality characteristics, of good and poor combat pilots, test development directed towards these personality areas might well yield selection instruments valuable in predicting effectiveness in combat.

It is recognized, of course, that tests developed to predict a given intellectual or personality function frequently, in practice, yield better prediction for some altogether different function. The implications of the factor analyses can, nevertheless, be considered to represent a starting point, and a frame of reference, for test development in this important area. A more pertinent commentary might be that doubt could be expressed whether the factor structure characterizing the performance of good and poor combat pilots in the last war would also characterize the performance of good and poor combat pilots in some future war, where operational conditions, and the functions of combat pilots, might be altogether different than in the hostilities recently concluded. This general question will be considered in the last chapter of this report.

Refinement of Criteria

The results of the factor analysis also have important implications for the refinement of criteria. Even allowing for the fact that the factors may represent "observed behavior syndromes" rather than fundamental personality traits, the analyses yield important insights into the major elements in the complex of characteristics which can be identified with "Good" and "Poor" combat performance. Such insights may lead to the development of improved criterion measures; for example, among others, to rating scale developments, and to more pertinent checklist materials.

Rating Scales. In terms of the "Core Factors" seven continua could be established, and adapted for use as seven elements in a scale for rating combat effectiveness. In this connection several points might be noted. The various items making up each "Core Factor" could not be used to define landmarks on the scale, since different items pertain to different aspects of the observed behavior defined by the factor in question, and in most cases could not readily be arranged along a continuum.

The item structure of individual factors could, however, be used in defining the specific observed behavior characteristics to be rated. In this connection the factor loadings carried by individual items could be used as a measure of the emphasis to be given to various aspects of the behavior in question.

In developing such a rating instrument for field use it would probably be desirable to include a scale on "Leadership" even though in this analysis a clear factor appeared only in the High analysis. This probably resulted, as noted previously, from the manner in which the questions were framed in

eliciting responses about the nominees. On the other hand, Low Factor E ("Reaction to failure") apparently represents a configuration of reasons for nomination that would have no apparent counterpart as descriptions of good combat pilots. This factor would probably not, then, be included in a "bipolar" rating scale.

It might also be noted that the present analysis has yielded information on the importance of the various characteristics rated.

Refinement of Checklist. Because of certain disadvantages inherent in rating scales, use of forced-choice checklists might still be desirable in collecting data on the combat efficiency of Naval aviators. The results of the factor analysis would be useful in refining the present checklist procedures. One of the disadvantages of the checklist procedures described in this report is that there was no opportunity for respondents to indicate whether, for example, certain High nominees also possessed certain characteristics which pertained to Low nominees.

Development of "bipolar" items might thus be suggested, on the basis of the implications of the factor analysis with respect to which pairs of A and B list items represent behavioral opposites. Or alternatively, the "Core Factors" themselves could be considered to represent items in themselves. The reduction in number of checklist items from more than 20 to 7 or 8 would represent a time saving advance.

Alternatively, the information yielded by the factor analysis, particularly with reference to the "Core Factors" might be used in developing new items descriptive of reasons for nomination.

Development of a "Word Portrait" Instrument. On the basis of the "Core Factors" word portraits of the seven opposed sets of characteristics of good and poor combat pilots might be prepared. After nominating a man for High or for Low, the respondent could be asked to indicate, for each of the opposed sets of characteristics, which of two word portraits applied most closely to the nominee in question. He could also be requested to indicate how well the description, checked as most appropriate, actually fit the nominee in question.

Such an instrument would have the advantage of the "forced choice" situation and would give an indication of degree to which the characteristic applied. It would also have the advantage of being relatively self-administrating, and economical with reference to time required for completion. Moreover, it would make possible the indication of negative aspects of certain traits as characteristics of High nominees, a situation that might well prevail, but which could not be ascertained by means of the reason for nomination procedures previously discussed in this report. Investigation of this point would be of considerable practical, as well as theoretical, interest.

Use of Paired Comparison Techniques. The fact that salient characteristics of good and poor combat pilots have been reduced to a reasonable number would make possible use of paired comparison techniques in obtaining measures of the degree to which given characteristics, as defined by individual factors, applied to given nominees.

Other Implications

The insights provided into the characteristics and the personality structure of good and poor combat pilots, as seen through the eyes of the respondents, have other implications

Indoctrination and Training. As noted in Chapter V preliminary analysis of reason for nomination data served as the basis for the pamphlet "The Pilot's Choice," outlining the characteristics of Naval Aviators who were acceptable, and the characteristics of those who were not acceptable, to their mates. On the basis of the factor studies, a more definitive brochure could be prepared, which would be extremely useful, as was the earlier booklet, in emphasizing that the key to combat efficiency is not represented merely by the attributes of a "hot pilot." The fact that leadership, teamwork, and practical intelligence ranked higher in importance as characteristics of good combat pilots than did aggressiveness and flying skill would seem of great practical importance in the indoctrination of cadets regarding their duties as Naval Aviators.

Clinical Insights. The "clinical insights" provided with reference to the observed characteristics of good and poor combat pilots also have implications for studies of leadership. These insights might also be valuable in treating cases of "combat fatigue" and other personality maladjustments. Finally if detailed clinical studies were undertaken of individuals nominated as "Good" and "Poor" combat pilots these insights into the structure of observed behavior characteristics or syndromes of "High" and "Low" nominees might well be of major importance as a starting point.

SECOND ORDER FACTOR ANALYSIS OF COMBAT CRITERION DATA

As indicated by inspection of Tables 7.07 and 7.08, the eight factors yielded by the factor analyses of both High and Low reason for nomination data, respectively, were not orthogonal, i.e., the factors were in general not uncorrelated. It appeared of interest to subject these matrices of intercorrelations among factors to a second order factor analysis to determine whether a still fewer number of perhaps uncorrelated superordinate factors could be defined. Such analyses were carried out, in terms of the Thurstone Centroid method, as described below.

Analysis of High Data

The matrix of intercorrelations among High factors yielded two second-order factors, the residuals after extraction of the second factor being negligible, the greatest residual being .105, only three being greater than .075, only six being greater than .050, and 22 of the 28 being .050, or less.[17] The Centroid Matrix is presented in Table 7.11.

The final factor matrix, after rotation in two dimensions, is given in Table 7.12, the graphic plot of the factor configuration after rotation being given in Figure 7.1. It will be noted that the two factors are relatively orthogonal. The structure of these factors is indicated below:[18]

I. "Fighting Ability"

F.	Combat Aggressiveness	.807
G.	Skill and Interest in Flying	.761
B.	Practical Intelligence	.354
H.	Teamwork	.264
D.	Conscientiousness	.212
A.	Sociability	.206
C.	Coolness, Steadiness	.148
E.	Leadership and Dependability	.082

II. "Combat Officer Qualifications" or "Capacity for Combat leadership"

D.	Seriousness, Conscientiousness	.845
B.	Practical Intelligence	.649
E.	Leadership and Responsibility	.560
H	Teamwork	.554
A.	Sociability	.404
C.	Coolness, Steadiness	.357
F.	Combat Aggressiveness	.143
G.	Skill and Interest in Flying	.042

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[17] One re-estimation of the communalities, and one repetition of the extraction procedure was required to achieve close agreement between the estimated and obtained communalities. In terms of the final extraction the estimated and obtained communalities were within .04, six of the eight pairs of communalities agreeing to within .02. In this connection, estimation of the communalities was based on values yielded by carrying the extraction process to three factors, in order to reduce the "error space."

[18] This configuration was yielded by a rotation from the centroid axes of 54° in a counter-clockwise direction. The direction cosines are given in Table 7.12.

TABLE 7.11

SECOND ORDER FACTOR ANALYSIS -- HIGH DATA

CENTROID MATRIX

	I	II	h^2
A	448	071	252
B	733	095	638
C	376	090	178
D	808	325	760
E	405	395	392
F	590	-568	685
G	482	-591	585
H	603	113	394

TABLE 7.12

SECOND ORDER FACTOR ANALYSIS -- HIGH DATA

FACTOR MATRIX AFTER ROTATION

	I'	II'	h^2
A	206	404	252
B	354	649	638
C	148	357	178
D	212	845	760
E	-082	560	393
F	807	143	686
G	761	042	584
H	264	554	394

Direction Cosines

	I'	II'
I	588	809
II	809	588

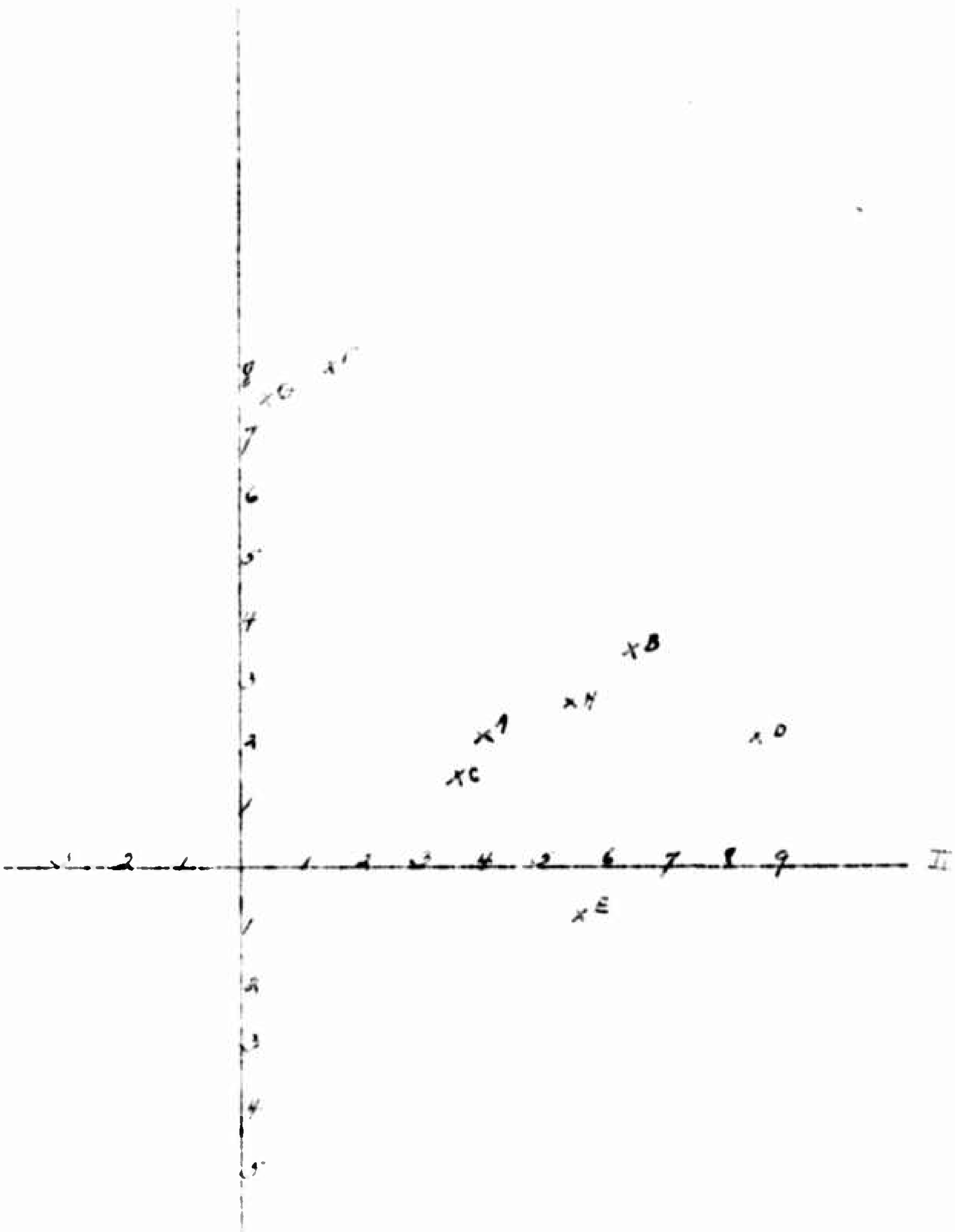

FIGURE [illegible] 1

PLOT OF HIGH MATRIX
AFTER ROTATION

FACTORS I and II

TABLE 7.13

SECOND ORDER FACTOR ANALYSIS -- LOW DATA

CENTROID MATRIX

	I	II	III	h^2
A	-273	-270	249	209
B	709	223	474	777
C	-376	391	032	295
D	121	-327	534	407
E	-136	-532	243	361
F	543	-336	-237	464
G	540	109	018	303
H	-375	081	266	218

TABLE 7.14

SECOND ORDER FACTOR ANALYSIS -- LOW DATA

FACTOR MATRIX AFTER ROTATION

	I'	II'	III'	h^2
A	402	-219	-003	210
B	-159	308	810	776
C	-250	-478	-069	296
D	482	016	419	408
E	601	000	-003	361
F	080	677	000	465
G	-208	396	320	302
H	121	-449	046	218

Direction Cosines

	I'	II'	III'
I	-221	827	514
II	-885	-395	250
III	411	-400	822

Factor I, with High loadings on F and G, a lower loading on B, and negligible loadings on the other variables can be tentatively designated "Fighting Ability."

Factor II carried appreciable loadings on all variables except F and G and appears something of a general factor. However, the high loading on D, and the relatively high loadings on Variables B, E, and H, suggest the designation "Combat Officer Qualifications." On the other hand since High nominees were predominantly leaders, (by virtue of the phraseology of the questions used in eliciting nominations,[19] and in terms of the fact that High nominees were generally of Higher rank than Lows, and probably of higher rank than the respondents) this factor might be termed "Capacity or Potential for Combat Leadership."

It is noteworthy that only one variable (Variable B) carried loadings of greater than .30 on both factors, the loading on Factor I being .35, on Factor II .65. This variable, perhaps, represents a rather pervasive characteristic, carrying weight in connection with both superordinate factors, although a heavier weight with respect to Factor II.

Analysis of Low Data

Three factors were extracted from the matrix of intercorrelations among the eight Low factors, it being evident that three factors accounted for the bulk of the variance in this matrix, no third factor residual being greater than .077, and only four of the 28 being greater than .050.[20] The centroid matrix for the High data is presented in Table 7.13, and the matrix after final rotations in Table 7.14. The factor plots are presented in Figures 7.2a, b, and c. Examination of these figures, and of Table 7.14, indicates that a reasonable approach to simple structure was achieved, and that the factors are remarkably orthogonal.[21] The structure of the three factors is

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[19] It will be recalled that respondents were asked to nominate for High men on whom they would be glad to fly wing.

[20] Two re-estimations of the communalities, and two repetitions of the extraction procedure were required to achieve close agreement between the estimated and obtained communalities. All but one of the obtained communalities were within .025 of the estimated communalities, the obtained and estimated communalities for Variable B differing by .07. It was not felt that serious distortion would be introduced by this single discrepancy.

[21] It is noteworthy that the results of independent rotations carried out by two investigators (E. S. Ewart and J. B. Carroll) were completely comparable in so far as interpretations were concerned, and showed very close agreement even with respect to absolute factor loadings. Variables carrying loadings of .30 or greater were identical in the two analyses, 9 of the 11 such loadings agreeing within .05. With respect to variables carrying loadings of greater than .30, and with one minor exception, the rank orders of variables, on each factor, in terms of magnitude of loading, were the same in the two independent analyses. This would indicate that the factor structure presented in Table 7.14 was in fact very clearly defined.

indicated below:

Factor I. "Emotional Inadequacy."

E.	Reaction to failure by mental mechanisms	.601
D.	Failure to take job seriously, lack of conscientiousness	.482
A.	Temperamental unsociability	.402
C.	Excitability, lack of coolheadedness	-.250
G.	Lack of job skill	-.208
B.	Lack of practical intelligence	-.159
H.	Foolhardy individualism	.121
F.	Fear syndrome	.080

The relatively high positive loadings of Variables E, D, and A, all of which carry connotations of "emotional inadequacy" appear to warrant designating Factor I by this term. If meaningful at all, the marginal, but negative, loading of Variable D probably denotes behavior that is over-cautious.

Factor II. "Fear-Impulsively Foolhardy" vector.

F.	Fear syndrome	.677
C.	Excitability, lack of coolheadedness	-.478
H.	Foolhardy individualism	-.449
G.	Lack of job skill	.396
B.	Lack of practical intelligence	.308
A.	Temperamental unsociability	-.219
D.	Failure to take job seriously, lack of conscientiousness	.016
E.	Reaction to failure by mental mechanisms	.000

Factor II with a high positive loading on F, lower positive loadings on G and B, and sizeable negative loadings on C and H, clearly represents a bipolar factor. On the one hand it could be designated the "Fear factor." In this connection the converse of the variables carrying negative loadings ("Excitability" and "Foolhardy individualism") probably denote "over-cautious" behavior, rather than the type of behavior denoted by their High analysis counterparts.[22] The low, but appreciable, positive loadings of Variables G and B are congruent with the findings of the principal factor analysis, in which reason for nomination items related to lack of skill and lack of practical intelligence carried loadings on the first order Factor F, "Fear Syndrome."

While on the one hand this second order factor could be denoted the "Fear Factor," reflecting the vector, and reversing its polarity, could

[22]It will be recalled, with reference to the discussion of the "Core Factors" that there was perhaps a less amount of correspondence, in a converse sense, between the respective "Core Factor" pairs C and H than was the case with other paired "first order" factors.

lead to the designation "Impulsively foolhardy," with **positive** loadings on C and H, and a marked negative loading on F, and lower negative loadings on C and B. This would appear to denote behavior that while impulsive and foolhardy, was also characterized by aggressiveness (the opposite of fear) and by a measure of flying skill. In terms of this reflection of the vector, the negative loading on B is somewhat anomalous, in terms of an apparent association of "practical intelligence" (as the converse of "lack of practical intelligence") with foolhardy behavior. It is probable, however, that in this context negative loading on the "lack of practical intelligence" does not in fact denote the **presence** of "practical intelligence" in the sense in which the factor was applied as descriptive of behavior of High nominees. It might, as a tentative hypothesis, refer to behavior that was strategically sound (i.e., shooting down an enemy plane) but tactically bad (i.e., deserting one's wingman in the process).

This bi-polar factor is represented by, and can probably best be termed, the "Fear -- impulsively foolhardy" vector.[23]

Factor III. "Lack of Practical Intelligence."

B.	Lack of practical intelligence	.810
D.	Failure to take job seriously, lack of conscientiousness	.419
G.	Lack of job skill	.320
C.	Excitability, lack of coolheadedness	-.069
H.	Foolhardy individualism	.045
A.	Temperamental unsociability	-.003
E.	Reaction to failure by mental mechanisms	-.003
F.	Fear syndrome	.000

Factor III, with a markedly high loading on B, appreciable loadings on D and G, and negligible loadings on the remaining variables, represents the type of behavior typified by the officer who is particularly marked by lack of practical intelligence, and who also fails to take his job seriously and is inadequate in flying skill. It can probably best be termed the "Lack of practical intelligence" factor. The association of "Failure to take job seriously" and "Lack of job skills" with "Lack of practical intelligence" is noteworthy.

Discussion of Factors

Of considerable interest is the fact that Variable D, "Lack of Conscientiousness," carries loadings of greater than .40 on two Low second order factors (I and III), suggesting, perhaps, the somewhat pervasive nature of this characteristic in terms of the observed performance of Low nominees. Also noteworthy is the suggestion that Low Factor I, "Emotional Inadequacy" appears to pertain, more generally than do the other Factors, to behavior not immediately concerned with flying *per se*.

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[23]It might be contended that the "Impulsively foolhardy" behavior represents merely over compensation with respect to fundamental feelings of "fear," i.e., that both poles of this bi-polar vector represent merely opposed types of reactions to fundamental feelings of "fear." This question cannot definitively be evaluated since the data pertain only to *observed behavior*

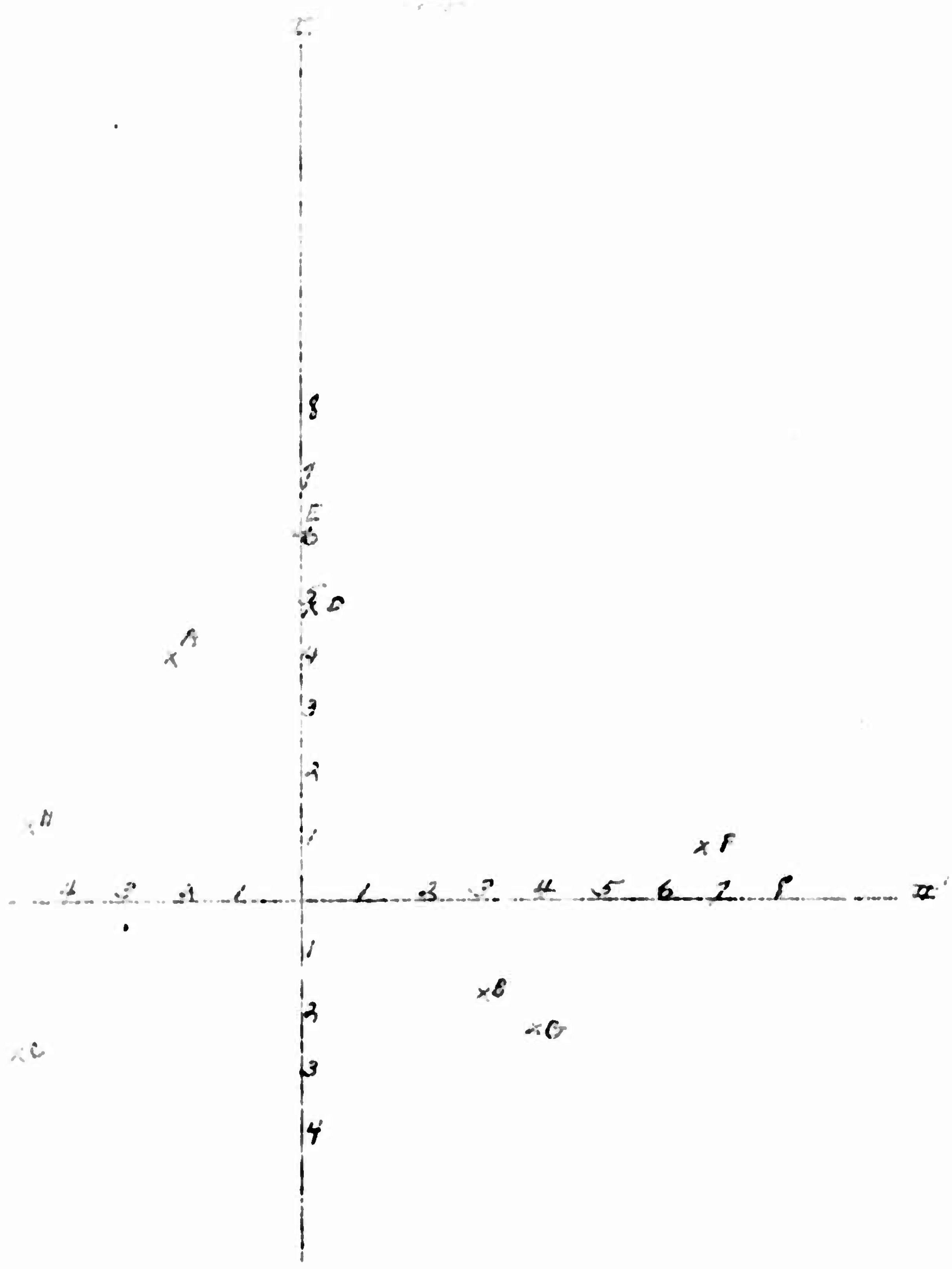

FIGURE 7.2a

PLOT OF LOW MATRIX
AFTER ROTATION

FACTORS I AND II

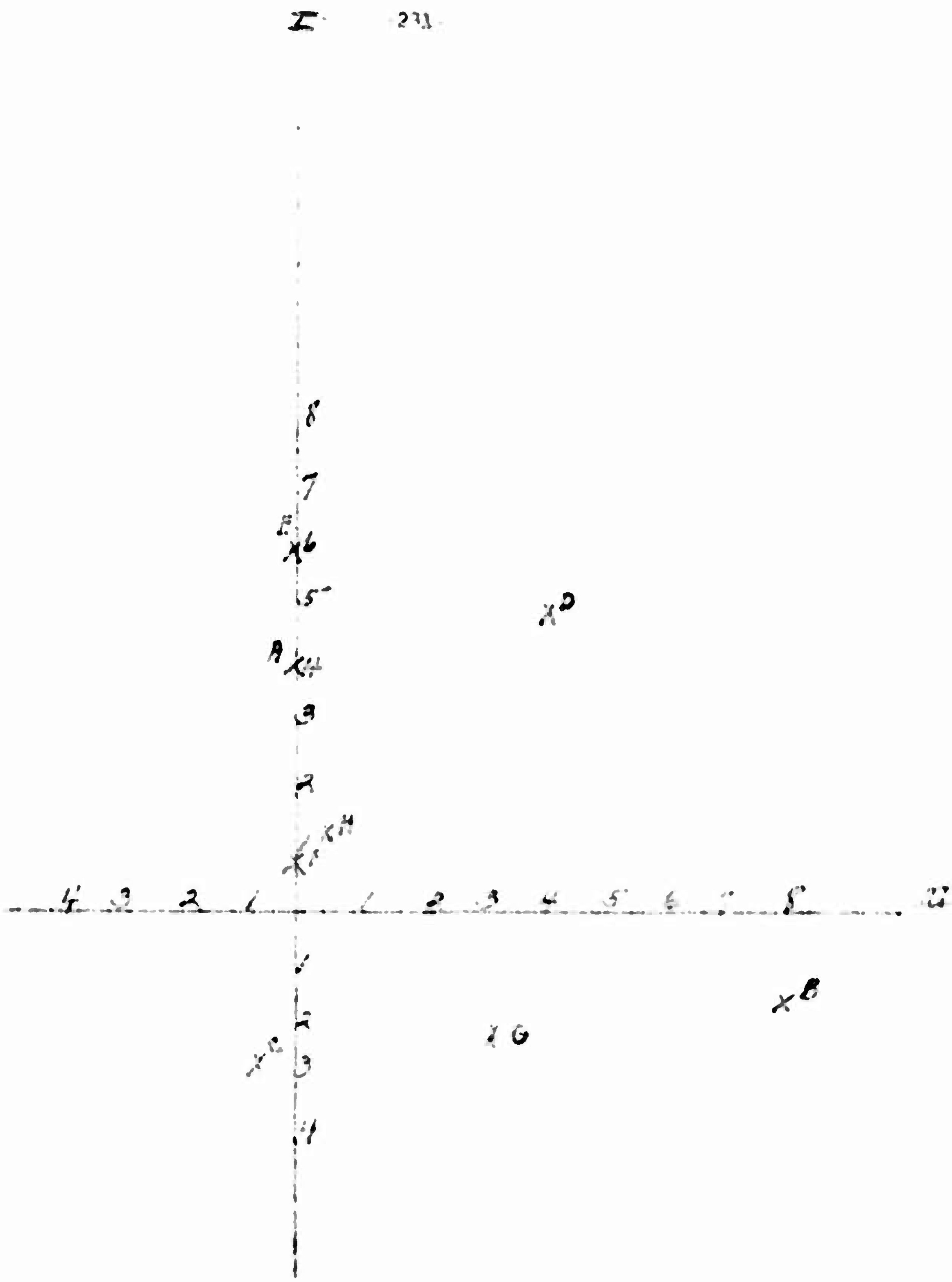

FIGURE 7.2b

PLOT OF LOW MATRIX
AFTER ROTATION

FACTORS I AND III

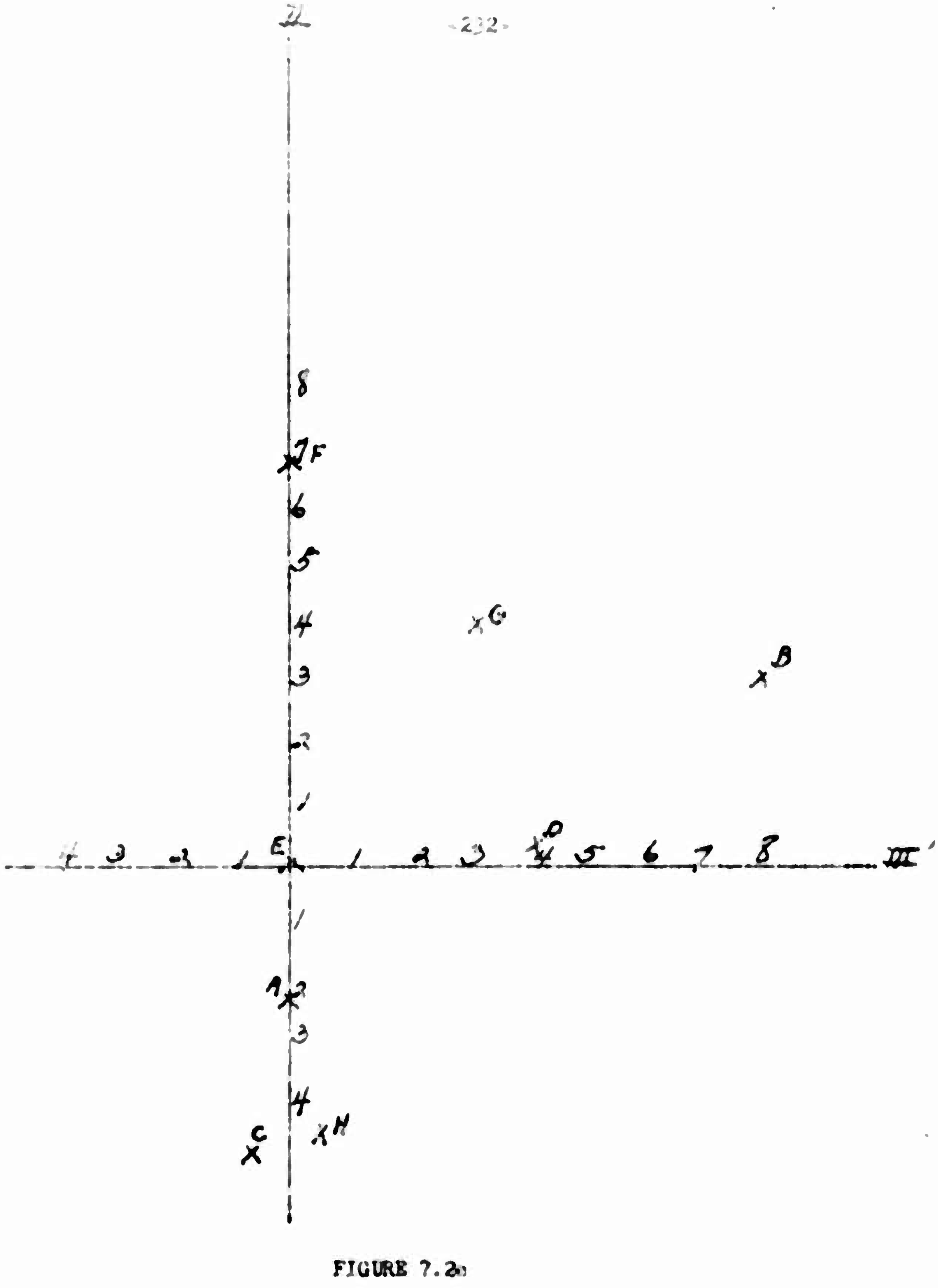

FIGURE 7.2b

PLOT OF LOW MATRIX
AFTER ROTATION

FACTORS II AND III

None of the Low second order factors appear to be very adequate counterparts of either of the two High second order factors. Even if more adequate matching were possible, it would be somewhat dangerous to interpret such paired factors as denoting directly opposite types of behavior, in as much as even with reference to the primary factors, behavior represented by a given Low factor differed somewhat from the direct converse of behavior represented by the High factor with which it was paired.

Nevertheless, it is of interest to note that the variables (primary factors) carrying positive loadings on Low second order Factor II (in terms of the "Fear" pole of the "Fear-Impulsively Foolhardy" vector) were the indicated converse of the variables carrying appreciable loadings on High second order Factor I ("Fighting ability"). Therefore, some general correspondence, in a converse sense, is indicated between behavior represented by High Factor I and the "Fear" pole of Low Factor II.

General Considerations

As was true of the factor analyses of the intercorrelations among reason for nomination items, the second order factor analyses have yielded implications for test and criterion development, although of a somewhat more general nature.

For example, the fact that the observed behavior of High pilots can be broken down into the general, and relatively unrelated, characteristics of "Fighting Ability" and "Combat Leadership" has important implications relative to flight training. The importance of behavior typified by the High second order Factor II has, of course, been recognized, as illustrated by the "Pilots' Choice" booklet (discussed in Chapter V) prepared for use during the war in emphasizing, during training, the importance of teamwork and leadership in combat operations. However, the isolation of two relatively uncorrelated major characteristics in terms of which observed behavior of High pilots can generally be described supplies a formalization and a clear rationale for such emphasis, and suggests, perhaps, the desirability of increasing such emphasis. It will be recalled that the reason for nomination items on which Factor II were based were in general judged, by combat pilots, to be more important than were the reason for nomination items associated with "Fighting Ability."

Similarly, with reference to the Low analysis, the importance of giving training in elements of "practical intelligence" is emphasized, as well as the importance of efforts to minimize "impulsively foolhardy" behavior. This latter subject was particularly stressed in the booklet "The Pilots' Choice" mentioned previously.

In general, the broad implications for training, test development, and criterion development would seem to be that aggressive "Fighting Ability" is not the only major characteristic of "accepted" combat pilots, nor "lack of fighting ability" or "fear" the only major characteristic of pilots who are not "acceptable" in combat.

The results of the second order factor analysis suggest another major characteristic of "High" combat pilots, namely "combat leadership," with the connotations of conscientiousness, practical intelligence, leadership, and teamwork indicated by the factor structure. These two major characteristics, moreover, appear relatively uncorrelated in the sample of "High" pilots.

The important characteristics of unacceptable combat pilots, in addition to behavior associated with "fear" appear to be "impulsively foolhardy behavior" (negatively related to "fear" among "Low" pilots), "Emotionally inadequate" behavior and combat behavior indicating "lack of practical intelligence." The last two characteristics appear to be almost completely uncorrelated with each other and with bi-polar "fear-impulsively foolhardy" syndrome.

Specific attacks on the problems of test and criterion development might well be directed towards the objectives as defined by the primary factor analyses. The second order analyses, however, have provided important insights into the complex inter-relationships between the primary factors, valuable not only in orienting test and criterion development research, but in yielding more general insights into the possible structure of effective and ineffective combat performance, as represented by the patterns of behavior of "High" and "Low" nominees.

CHAPTER VIII

RECAPITULATION, DISCUSSION, AND IMPLICATIONS FOR THE FUTURE

The purpose of this final chapter is to recapitulate the outcomes of the analyses discussed in this report, to review and integrate evidence relative to the validity of the criterion, and to discuss the implications of the project as a whole for administrative policies and procedures as well as with reference to future research.

RECAPITULATION

Preliminary Investigations

Genesis of the Project. The primary purpose of initiating combat criterion research was the establishment of a criterion against which selection tests could be validated. It was recognized, of course, that such research would have many other ancillary implications of a practical as well as a theoretical nature.

Development of Nomination Technique. The procedure which proved of greatest utility in establishing criterion groups of "good" and "poor" combat pilots was the "nomination technique." In essence this technique involved eliciting from Naval aviators with combat experience, "nominations" as "Highs" of two men known to them on whom they would be glad to fly wing; and as "Lows," of two men whom they would not want flying wing on them. Provision was also made for indicating reason for nomination.

Specific details of the procedure evolved from work of H-V(S) psychologists both in the Aviation Psychology Branch in Washington and in the field. Preliminary collection of data and a survey of data-collection possibilities was made by Captain (then Commander) J. G. Jenkins during a tour of duty for this purpose in the Pacific Ocean Area early in 1944. During this tour one squadron on an aircraft carrier was studied intensively.

Preliminary Field Investigation. On the basis of procedures developed in this early work a field investigation was initiated. In this investigation a manual of procedures developed by Captain Jenkins was utilized. These procedures involved collection of nominations through individual interviews with pilots. Data on reason for nominating specific pilots as "High" or "Low" combat aviators were of the "free response" type, i.e., the interviewer summarized, in some detail, the respondent's comments regarding his reasons for nominating specific pilots for the "High" and "Low" groups. Great care was taken, of course, to render this information regarding individual Naval officers completely confidential for use only in research. Some nominations in this preliminary field investigation were obtained from combat pilots who had returned to the States.

Outcomes of Preliminary Investigation

This work yielded data on 1793 cases. There were three major outcomes of this preliminary investigation.

Categorization of Free Response Material: Establishment of Categories. It was recognized, of course, that the free response data pertaining to reason for nomination would be of little use unless they could be coded. After considerable research 33 categories were established in terms of which the free response material could be reliably classified.

Frequency of Use and Judged Importance of Categories. Studies were made of the frequency of use of the various categories, and the importance of the behavior characterized by the various categories was judged by a group of combat pilots. Certain categories were used frequently in describing both High and Low pilots; others were used predominately in describing High pilots; still others predominately in describing Lows. In general, categories used frequently for both High and Low nominees pertained to sizing up situations in the air, dependability, agressiveness, and calmness and coolheadedness.

The relationship between frequency of use, and judged importance of categories was not, however, markedly high, the rank order coefficient being .56. For example, the category pertaining to deserting one's mates to save one's own neck was rated twenty-first in frequency of use, but first in terms of importance.

"Clustering" of Categories. Considerable experimentation was done in an effort to establish superordinate classifications into which the categories of reasons for High and Low nomination could be expected to fall. Limitations of the data rendered impractical a definitive statistical approach to the problem. However, "clustering" of the categories, on rational grounds, was accomplished by a group of Psychologists in the AAF, and by a group of combat pilots. The designations given to these clusters are listed below:[1]

Psychologists	Pilots
1. Teamwork	1. Lacking in Teamwork
2. Emotional Stability	2. Lacking in motivation for combat
3. Practical Intelligence	3. Emotional inadequacy
4. Officer-like qualities	4. Intellectual or peceptual inadequacy
5. Basic and accessary skills	5. Lack of minimal skills
	6. Immature

The Pilots' and Psychologists' Clusters 1 and 5 were quite comparable. The Psychologists' Cluster 3 was exactly comparable to the Pilots' Cluster 4.

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[1]The Psychologists' Clusters were identified in terms of a positive description of the cluster; the Pilots' Clusters in terms of the negative description. Both sets of clusters, however, were based on the same set of reasons for nomination categories.

and the Psychologists' Cluster 4 was relatively comparable to the Pilots' Cluster 6. The chief interest in these clusters is with reference to their comparability to factors defined by statistical analysis of correlations among reasons for nomination based on subsequent and more adequate data.

Prediction of Nomination. A number of analyses were carried out with reference to the relationship between test scores and nomination for High and Low. These analyses were not definitive, however, although some suggestion of predictive significance was evident for the Mechanical Comprehension Test and for the Personnel Test. No promise was shown, relative to prediction of the combat criterion, by the Biographical Inventory. These findings were equivocal, due to the influence of extraneous factors associated with rank, and other variables.

Large Scale Collection of Data in Pacific Ocean Area

Steps were taken in the fall of 1944 to obtain data on a larger number of subjects in combat areas. Data collected in the preliminary investigation were considered somewhat inadequate for a number of reasons, among which were the facts that not all of the data had been collected through use of identical procedures; some of the cases had been collected stateside; and the number of subjects for whom selection test data could be located was too small to make possible definitive analysis.

Four H-V(S) officers were assigned to tours of duty in the Pacific Ocean Area for the purpose of interviewing a large number of pilots and obtaining nominations for the High and Low criterion groups. Detailed procedures were worked out in the Aviation Psychology Branch under the direction of Captain Jenkins, and were later modified following initial experience in the field.

Procedures. The procedures finally employed entailed obtaining nominations through group administration procedures rather than on the basis of individual interviews. Reasons for nomination were given by indicating which items on a checklist applied to the nominee in question. The checklist for High nominees consisted of 22 items, or "reasons for nomination;" the checklist for Low nominees consisted of 26 items. These items were developed primarily on the basis of the categories in terms of which free response material had been classified in the earlier investigations, and on the basis of research and preliminary work which had been done utilizing these categories.

Special forms were used on which each respondent indicated the names of two High nominees and two Low nominees, and the checklist items which applied as reasons for the nomination. The respondent was then to indicate the three of these items which were the most outstanding considerations as reasons for the nomination. Appropriate security measures were of course taken to "disidentify" and to render this information confidential, during its transmission back to the Aviation Psychology Branch.

Number of cases. A total of 2872 pilots was interviewed, including

2047 single-engine pilots and 825 multi-engine pilots. Names of 4,325 nominees were obtained. Some respondents did not nominate two Highs and two Lows, and 40 per cent of the nominees were nominated by two or more respondents.

Results of Analyses of Data

A number of extensive analyses were made of the data collected in the Pacific Ocean Area. These included analyses of nominations for High and Low; analyses of reasons for nomination; determination of the relationship between selection test scores and nomination for High and Low, for specific reasons; and factor analyses of the reason for nomination data. The results of these analyses will be summarized below.

Analysis of Nomination for High and Low. The results of this analysis, presented in Chapter IV, may be summarized, as follows:

1. The group of men interviewed by the field investigators represented a relatively complete sample of the eligible respondents in the Air Groups visited.

2. The 4325 nominees represented approximately 50 per cent of the pilots on the Air Group rosters at the time data were collected, the incidence of "outsiders" among Low nominees being markedly greater than among High.

3. About 53 per cent, or 2274, of the men were nominated for High, 42 per cent, or 1829 men, being nominated for Low. There were 222 Mixed cases, representing about 5 per cent of the total number of nominees, and about 13 per cent of the total number of multiply nominated officers, i.e., men who were nominated two or more times.

4. About 40 per cent (1727) of the nominees received two or more nominations. Senior officers nominated High received more multiple nominations than did Junior officers nominated High. There was no significant difference in number of multiple nominations among Junior and Senior officers nominated for Low.

5. There was little difference in incidence of High and Low nominations in terms of breakdowns by Regular and Reserve Status, and in terms of specialty classification. There was, however, a difference in incidence of High and Low nominations in terms of Rank. A disproportionately large number of High nominees were Senior officers and a disproportionately large number of Low nominees were Junior officers. An analysis of data from a subsample consisting of 10 Air Groups indicated, however, that while the proportion of all pilots on the rosters nominated for High was greater among Senior than among Junior officers, the proportion of all pilots "on board" nominated for Low was relatively constant from rank to rank.

6. Analysis indicated that the incidence of High nominations among squadron "regulars" was markedly greater than among "floaters," i.e., men who were

not on the roster during the complete tour of the squadron.

7. The reliability of the nominations was estimated to be in the neighborhood of .80. The general adequacy of the reliability of the nominations is also suggested by the relatively few "Mixed" nominations which were obtained.

Analysis of Reasons for Nomination. Analyses of reason for nomination data, covered in Chapter V of this report, may be summarized as follows:

1. The item most frequently used as an outstanding reason for High nomination was "Feels responsible for safety of all personnel flying in combat with him." The most frequently used "Circled"[2] reason for Low nomination was "Erratic, unpredictable...." The reason "Excellent in gunnery, etc." was least frequently used as a circled reason in nominating both Highs and Lows.

2. The agreement in terms of frequency of use between reasons for High and Low nominations was not great (rho = .25 for all reasons and .38 for "outstanding" reasons). In general, reasons most frequently used for High pertained to ability as a teamworker; for Low, to undependability. It is significant that reasons pertaining to mere technical adequacy (e.g., "Excellent in gunnery, etc.") were used, relatively, with less frequency than many others.

3. There was considerable agreement between frequency of use of reasons as circled and uncircled entries (rho = .67 for High reasons, .68 for Low). Due to the overlapping nature of these classifications, considerable agreement could be expected. However, items pertaining to certain personal characteristics, such as "Doesn't mix," "Even tempered" were used relatively infrequently as circled (or outstanding reasons) for nomination, and much more frequently as uncircled entries.

4. Difference in frequency of use of reasons for nomination, in terms of specialty classification of the nominee, was generally a reflection of difference in equipment and type of missions flown. This conclusion could be more clearly drawn, however, with reference to reasons for High, than for Low, nomination.

5. Analysis of the influence of rank of the nominee in respect to frequency of use of reasons for nomination for High, indicates that the item "... a leader of men.." was markedly more frequently used in describing Senior officers, than Junior officers. Marked differences in frequency of use of other High reasons were not evident. The converse of this High leadership item did not show marked difference in frequency of use between Junior and Senior officers as a reason for Low nomination. However, Item 2, pertaining to maturity, was relatively more frequently used as a reason for nominating Junior, than Senior, officers for Low. In addition, the items "Evades..combat missions" and "Likely to blow up" were more frequently used in connection with Senior than Junior officers nominated Low.

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[2]The respondents indicated all reasons for nomination applicable to their nominee, and then indicated the three most outstanding reasons. These latter are termed "circled" reasons for nomination.

6. The items "Feels responsible for safety (of others)"; "Alert.."; ".. a real leader," and "Steady and reliable.." were judged most important as reasons for High nomination; the items "Too worried about own safety"; "..takes foolish risks"; "No sense of teamwork" were judged most important for Low. There was greater agreement between judged importance of reasons for High and for Low, than was the case with frequency of use.

7. There was little agreement between judged importance of items and their frequency of use, although the item "Feels responsible for safety of others" was first in terms of both frequency and importance. In general, personal attributes, such as "Doesn't mix," ranked higher in terms of frequency of use than in terms of judged importance. It may be significant that the relationship between judged importance of an item for Low, and the frequency of use of the converse of the item for High, was greater than was the relationship between frequency and importance for either High or Low items, respectively.

8. Estimation of the reliability of the reasons for nomination indicated that reasons for nomination for Low were much more reliable than reasons for nomination for High.

Prediction of Nomination Status. Analysis of data from the complete sample indicated that with respect to prediction of nomination status (High vs. Low) some suggestion of predictive value was evident for the Mechanical Comprehension Test, and also for the Personnel Test, although none was indicated for the Biographical Inventory. Such relationships as were evident were not, however, of a degree associated with practical predictive significance. Moreover, more adequately controlled analyses on sub-samples of the data indicated that such indications of prediction as were evident could be explained by the operation of extraneous factors, and thus could be considered artifacts. The relationship between test scores and individual reasons for nomination could not adequately be evaluated, due to the fact that such extraneous factors could not adequately be controlled.

Some promise in predicting nomination status was, however, indicated for "Combat Keys" developed for scoring the Biographical Inventory. These keys, on samples homogeneous in terms of rank and experience, yielded discrimination over three independent cross-validation samples. While these results could not be considered, in themselves, to indicate practical predictive significance for the specific keys involved, the possibility of developing instruments for the prediction of this combat criterion was quite clearly indicated.

Factor Analysis of Nominations. As a result of the factor analysis of intercorrelations among reason for nomination data eight interpretable factors were extracted in the analysis of High and Low data, respectively. Seven of the eight factors had counter-parts in both analyses. These factors were termed:

A. Sociability
B. Practical Intelligence
C. Coolheadedness
D. Conscientiousness

F. Combat Aggressiveness (vs. Fear syndrome)
G. Skill in flying
H. Teamwork (vs. Foolhardy individualism)

One factor (Factor E, designated "Leadership and Responsibility") was unique to the High analysis, and one factor (Factor E, designated "Reaction to failure by mental mechanisms") was unique to the Low analysis. This lack of correspondence of the two analyses, as well as a degree of the non-correspondence among factors common to High and Low analysis, could be explained, in some part, by the design and conditions of the research, and by the way certain items had been phrased.

The eight factors isolated by the analyses of High and Low data respectively were not uncorrelated. The matrices of intercorrelations among factors were therefore also subjected to factor analysis. The High data yielded two second order factors, designated, respectively, I "Fighting Ability" and II "Capacity for Combat Leadership." The Low data yielded three second order factors, designated respectively, I "Emotional Inadequacy," II the "Fear-Impulsively Foolhardy" vector, and III "Lack of Practical Intelligence."

The implications of these results have been discussed with reference to selection test development and validation, refinement of criteria, indoctrination and training, as well as in regard to pertinent insights into the make-up of combat proficiency or the lack of it.

CONTRASTS IN HIGH AND LOW NOMINATIONS

At the risk of undue repetition it seems wise to review and to integrate the implications of certain of the qualitative differences in the High and Low nomination data.

Although differences between Highs and Lows in frequency of use of reason for nominations could in some part be explained in terms of the phraseology of the questions used to elicit nominations, and in the phraseology of the reason for nomination items themselves, it is noteworthy that the reason most frequently used for High nominations concerned "Teamwork"; for Lows, "Undependability." Perhaps the most striking difference in frequency of use, associated with rank, was the fact that among Low nominees "Evades combat missions" and "Likely to blow up" was used with markedly greater frequency in nominating Senior, than in nominating Junior, officers. Furthermore, higher intercorrelations among items, and among factors, were evident in the analyses of the High, as compared with the Low, data. This suggests that the reason for nomination items were applied (by the respondents) with more specificity to the Low nominees than to the Highs. It appears that the behavior of the High nominees tended to be "globally good." Lows, apparently, were considered unacceptable more specifically for the reasons indicated.

In this connection an important insight is yielded by the factor analysis. Among Highs the factors "Teamwork" and "Combat Aggressiveness" correlated positively although low (.26), suggesting at least some trend for these two observed characteristics to be positively related. Among Lows, however, the

counterparts of these factors, "Foolhardy individualism" and "Fear" correlated negatively (-.30). It might be suggested that Low men, so nominated by reason of being foolhardy and impulsively individualistic, tended not to be stigmatized also for cowardice, or in terms of behavior associated with the "Fear syndrome." This indication is further supported by the isolation of a bi-polar factor in the second order factor analysis of the Low data. This factor was designated the "Fear-Impulsively Foolhardy vector."

A third contrast of interest is the fact that estimates of the reliability of reasons for nomination for Low were generally higher than were the estimated reliabilities of reasons for nomination for High. Moreover, the relatively high rank order relationship between frequency of use of reasons for High (as circled entries) and judged importance of the converse of the High reasons as Low characteristics, suggests that the respondents may have tended to tag their High nominees with the converse of the reasons they considered most reprehensible as Low characteristics. This might follow if, as noted previously, High men were nominated for more general reasons, and the respondents had some difficulty in singling out the three outstanding reasons for High nominations.

These results, together with the not unequivocal evidence that nominations for Low were a function of rank to a lesser degree than were nominations for High, may suggest that nominations for Low are more clear-cut and stable than are nominations for High. It therefore seems wise, at this point, to consider the evidence for the validity of the nomination technique in general.

VALIDITY OF THE CRITERION

Nomination Data as an "Ultimate" Criterion

Data yielded by the nomination technique can be considered to have more than mere "face validity." In fact there is much that is cogent in the position that the nomination technique yields "ultimate" criterion data. This argument has two facets. One is the point that acceptability to one's mates in the life-and-death struggle for existence which air combat represents is the crucial measure of combat effectiveness. The other facet is that granting something more than acceptability is involved, nobody is in a better position to judge a man's effectiveness in combat than the men who fly with him and whose very lives may well depend upon his adequacy in the combat situation.

As stated in Aviation Technical Memorandum Number 4, the development of the nomination technique was premised on four considerations, viz:

"(a) The level of skill required. -- It was believed that the flight skill requirements of combat aviation were sufficiently rigorous to provide a clear separation between the best and the worst performers.

"(b) The length of exposure. -- The fact that a given air group stays in a combat area for six months or more will cancel out adventitious assignment to the HIGH or LOW groups, to the extent that men do nominate pilots whom they have known intimately in combat; rather than pilots who have been eliminated prior to combat operations.

"(c) The risks involved. -- The fact that combat aviation is a life-or-death matter should tend to separate the men from the boys. Where a lower level of risk might leave us with a non-distributed group, it was felt that lethal combat possibilities should work to separate the extreme of the groups involved.

"(d) Opportunity for observation. -- Since all carrier operations and many land-based operations involve more than one airplane, the men making the assays should be able to base them in general on direct observation rather than on second-hand evidence or hearsay. Our instructions require that the nominee be known personally to the respondent."[3]

Arguments Against Validity of Technique

In view of the evidence that nominations for High or Low are quite reliably made[4] the only general criticism that could be leveled at the validity of the technique would seem to be the allegation that nominations were made in terms of observed behavior other than, and not related to, combat effectiveness.

Since the chief characteristic of High and Low nominees appeared to hinge on acceptance, or lack of it, as a member of the combat team[5] it could be argued that acceptance was judged, by the respondents, in terms of the nominee's general social and personal acceptability -- whether or not he was a "good Joe" -- or in terms of his prestige or reputation rather than in terms of his effectiveness in combat *per se*. Arguments for the authoritative nature of the criterion data notwithstanding, this criticism must certainly be answered.

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[3]From: Aviation Psychology Technical Memorandum Number 4, Washington, D.C.: Navy Department, Bureau of Medicine and Surgery, Division of Aviation Medicine, December 1944.

[4]It was estimated that the reliability of nomination for High or for Low was in the neighborhood of .80. Moreover, relatively few men were nominated both for High and for Low. Although the number of mixed cases represented about 13 per cent of the total group of multiply nominated men (or about 5 per cent of the total group), the bulk of the mixed cases nominated by more than two men received only one nomination opposite to the plurality of nominations received.

Nominations for specific reasons were, of course, less reliable, particularly with reference to High nominations. Estimates of reliability of reasons for nomination were, however, considered to be somewhat too low, and moreover reliabilities in terms of reasons for nomination could be increased by dealing with factors or clusters of reasons.

[5]Both as indicated by the questions asked to elicit nominations, and in terms of the findings yielded by the analysis of reason for nomination data.

Implications of Obtaining Extreme Criterion Groups

The argument that nominations were influenced unduly by personal likes or dislikes would have considerable merit if the respondents were required to indicate how every member of their squadron should be nominated. Under these conditions it would appear quite possible that in case of doubt the nominations might well have been made in terms of the respondent's personal like or dislike for the man in question. The fact, however, that the respondents were for the most part experienced combat pilots, and were asked to nominate for High and for Low only two men, living or dead, and who were personally known to them casts a different light on the matter.

It would appear, on logical grounds, quite unlikely that under these conditions men would be singled out for Low who were social pariahs, but otherwise reasonably good combat pilots. Similarly it would be unlikely that men would be nominated for High who were extremely good drinking companions but also only reasonably good combat pilots. It might even be granted that High nominees were characterized by social acceptability and Low nominees by lack of it. Regardless of whether such qualities are related to combat effectiveness it seems extremely unlikely, in nominating men for widely disparate criterion groups, that the nominations were made without regard to performance in combat.[6]

Implications of Factor Analysis. With reference to this problem the results of the factor analyses, and other analyses of reason for nomination data are pertinent. The factor analysis did isolate a "Sociability" or "good Joe" factor in the analyses of High and Low data. However, the intercorrelations of this factor with others were extremely low, lower in fact than were the intercorrelations of most of the other factors.[7] Moreover, the correlations among reasons for nomination were not markedly high, and in fact were of remarkably small magnitude in the Low analysis. The results of the analyses indicate that nominations were made for specific configurations of reasons, and not on the basis of some generalized feeling state in the respondents.

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[6] Such an implication would suggest that the respondents had no clear definition of combat effectiveness that could be expressed other than in general terms of personal like or dislike. The bluntness with which reasons for nomination were given, suggests strongly that this was not the case, and that very clearly formulated ideas as to the nature of combat effectiveness did exist in the minds of the respondents.

[7] In the High analysis, the Sociability factor correlated as great as .30 and in no case as great as .40 only with Factors D and H, pertaining respectively to attention to duty and teamwork. In the Low analysis, the Temperamental Unsociability factor correlated as much as .20 only with Factor E, pertaining to reaction to failure, the coefficient being .23.

Implications of Relationships between Frequency of Use and Importance

It might be postulated that one measure of the validity of the criterion data might lie in the relationship between frequency of use of individual reasons for nomination and the judged importance of these reasons. Data relative to this problem are not clearly in favor of the hypothesis of validity, the relationship between frequency of use and judged importance of reasons for nomination being low both for the free response data, and particularly for the checklist data from the principal investigation.

It might be noted in this regard, however, that these reasons were considered by the respondents to be descriptive in nature, and that there was no imputation that the reasons most important to combat aviation should be checked. In this regard it is significant that the relationships between frequency of use and judged importance while by no means strong, were stronger for circled items than for uncircled.[8] Moreover, certain "personality" characteristics showed evidence of being used less frequently as circled than as uncircled items. For example, the item referring to being a "good mixer" ranked third as an uncircled reason for High, but tenth as a circled reason. Among Low the item "Keeps to himself ..." ranked first as an uncircled reason, but twenty-second as a circled reason.

The general lack of relationship between frequency of use and importance clearly suggests, however, the desirability of considering reason for nomination factors in further analyses involving these data, since, in these terms the criticism that less important reasons for nominations might be overemphasized can to a large extent be negated. It will be recalled that the factors were markedly differentiated in terms of the mean importance rank of the items by which they were constituted. Items making up the factors designated "Leadership," "Teamwork," "Practical Intelligence," and "Combat Aggressiveness" stood high, both relatively and absolutely, in terms of the mean of their judged importance ranks. Through consideration of such factors the influence of less important, and perhaps perf[illegible]ily given, reasons for nomination can be minimized.

Implications of Relationships between Rank and Nomination

The very clear evidence of a relationship between rank and nomination status might be considered one of the most damaging bits of evidence in support of the criticism that nominations were made on some basis other than pure combat effectiveness. That is, it might be argued that the major part of the variance in the criterion could be attributed to rank.

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[8] For High reasons the rank order coefficient between frequency of use and judged importance was .40 for circled reasons and .06 for uncircled. For Low reasons the coefficients were .20 and -.09. Incidentally, if frequency of use vs. judged importance were taken as a measure of validity, Low nominations should be considered less valid, a conclusion in opposition to several of the implications in the data.

It might be argued, of course, that rank is a necessary correlate of combat efficiency, on the grounds that men of higher rank, and thus of more experience, could be expected to be the better combat pilots, and on the grounds that men selected for promotion tended to be better qualified than those passed over. Furthermore, in this connection, the relationship between rank and combat proficiency might be considered greater when men in the combat area are being dealt with, since it might be expected that the higher ranking officers markedly deficient in combat performance would have been transferred to duties other than combat aviation more quickly than lower ranking officers who, similarly, were deficient combat pilots.

On the other hand during wartime, promotions tended to be given more or less automatically after certain periods of service. Moreover, relatively late in the war when nominations were collected, many pilots of higher rank had accumulated, actually, little combat experience, being previously engaged in non-combat flying, for example as instructors, NATS pilots, etc. The possibility should be recognized that the rank-nomination status *might* indicate that nominations were made in terms of a prestige factor, or other variable, related to rank, but not necessarily to combat efficiency.

Therefore, although much can be said on both sides of the issue, conservative interpretation of the data demands that the rank-nomination status relation not necessarily be considered evidence for the validity of the criterion, and that other explanations of this relationship be examined.

Effect of Question Phraseology. Explanations of these rank vs. nomination status findings have been discussed. It may well be, however, that the most pertinent explanation, relating to the phraseology of the questions used in eliciting nominations from the respondents, has not been considered fully. It may well be that this relationship between rank and nomination can be explained in terms of the requirement (perhaps *a posteriori* an unfortunate one) that High nominees be considered pilots, known personally by the respondent, on whom he *would gladly fly wing*, and that Lows be considered pilots whom the respondent *would not want flying wing on him*.

If the respondents took these directions seriously in reflecting on the qualifications of their mates, it would be logical that they would in general select for the High group men on whom they personally and individually had actually flown wing. Their mental process might be characterized by the statement, "I've flown wing on A, I know he's good."[9] Such men, however, would tend to be officers senior to the respondent, (at least at the time during which the nominee was associated with the respondent).

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[9]Officers whom the respondent knew only as a wingman might also be nominated for High on the basis of adequacy shown in this capacity, but the incidence of such occurrences would not be expected to be large.

The situation with respect to Low nominees might well not be the converse.[10] True, in many cases the mental process might be "This man has flown wing on me and left me in the lurch, I know he's lousy." On the other hand, the mental process with reference to other nominees might be characterised by "I've flown wing on this man and he's got me in trouble, and I certainly wouldn't want him flying wing on me." Thus nominees for Low might not tend so exclusively to be pilots of lower rank than the respondent.

Stated differently, men nominated for High might well have been proven leaders, thus men of higher rank; excellence as a wingman might not have represented conclusive evidence, in the minds of the respondents, that the man would be a good pilot to fly wing on. On the other hand, men nominated for Low might include not only pilots who had proved themselves inadequate as wingmen, but also men who had proved inadequate as section leaders and on whom the respondent, by this token, would not want flying wing on him. Such a group of men would contain individuals of both higher and lower rank than the respondent.

Support of these hypotheses is suggested by evidence that the reason for nomination relating primarily to leadership characteristics (Item 17) was more frequently used in describing Senior, than Junior officers among <u>High</u> nominees, but that the reason for nomination referring to <u>lack of leadership</u> (also Item 17, but in the B list) was used with <u>about the same incidence</u> in describing Senior and Junior <u>Low</u> nominees. The appearance of a "Leadership" factor in the High but not in the Low factor analysis also is in line with this bit of evidence. Moreover this hypothesis would explain the fact that among <u>High</u> nominees, the proportion of pilots, on the roster of 10 Air Groups, who were nominated was a function of rank, whereas among <u>Low</u> nominees, the proportion of pilots on the roster who were nominated was relatively independent of rank.

There is little definitive in the way of data in support of this explanation. It does, however, seem to fit many of the facts, and if tenable at least in part, removes to a great degree the stigma which may entail from the relationship between nomination status and rank.

<u>Nomination Status of CO's</u>. Some evidence regarding nomination status with respect to rank is yielded by analysis of nomination data on 65 Squadron Commanding Officers. Of these, nine (or 14 per cent of the group) were not nominated; 39, or 60 per cent of the group were nominated for High, whereas 8, or 12 per cent of the group were nominated for Low. Nine others (14 per cent of the group) received mixed nominations, six of these being nominated more often for Low than for High. The average number of High nominations per man was 8, the average number of Low nominations a little over 6. Of

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[10]Although on first thought one might expect that the phraseology of the question would have resulted in the bulk of Low nominees being subordinate officers, and thus relatively of low rank.

the 15 Multi-engine squadron commanders in the group only 3 were nominated for High, 4 were nominated for Low and 3 others, although receiving "mixed" nominations were nominated more frequently for Low than for High. Five of these Multi-engine squadron CO's were not nominated.

This evidence on Squadron Commanders would suggest that the technique was no respecter of rank, *per se*, although it should be recognized that duties attendent to the role of Squadron Commander might develop personal animosities which were not necessarily related to combat proficiency in general and might have influenced the number of Low nominations received by the CO's. This tendency might not apply to such a degree to the nomination of all Senior officers. Nevertheless these data, indicating that one fourth of this group of CO's were either nominated exclusively for Low or received mixed nominations, suggest that the influence of Rank was not too important. This is particularly true when an alternative explanation, in terms of the experimental procedures themselves explains not only the higher incidence of Senior officers among Highs, but also the fact that the proportion of pilots on the Air Group rosters, nominated Low, was relatively independent of rank.[11]

Validation Against "Outside" Criteria

Problems. It would have been desirable to validate the nomination criterion data against outside measures of combat proficiency, had such criteria been readily available. Unfortunately they were not, and if they had been, such extensive investigation of the nomination technique might not have been initiated.

For example, there were a number of reasons why attrition was not used as the major criterion. First, the use of attrition data would have required a complicated set of administrative reports from the combat areas. These were neither readily available nor could they feasibly be obtained. Second, combat attrition data, to be realistic, would have to be based on a considerable length of time during which the men involved would be "exposed" to attrition of various kinds. Third, it was known from preliminary studies that many "poor" pilots remained with their squadrons (often in a non-flying status) for rather long periods of time and hence would not show up in attrition data unless the attrition figures were maintained over a period of several years. Since there was no guarantee that satisfactory attrition data could be obtained, the nomination criterion seemed to be preferable since it offered an immediate evaluation which appeared to have a high degree of reliability, and much face validity.

In this connection, no analysis of the combat criterion data has been made with regard to loss of aviators through enemy action. It was felt (and

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[11]As noted previously in this chapter and in Chapter IV this lack of rank-nomination status relationship among Lows could also be explained in some measure by the operation of selective factors. That this entirely accounts for the situation appears unlikely, however.

this belief reflects the attitude of most of the pilots) that being killed or shot down in combat was primarily an accidental circumstance which was not necessarily the fault of the individual involved. In fact, in air-to-air combat it was often the fault of the man's wingman or section leader, through failure to give proper cover. In air-to-ground combat, being shot down was largely a matter of which plane the shell happened to hit.

The one area of attrition of this type which might have given good results as a criterion is attrition due to "operational" losses, without the involvement of enemy action. Operational losses (e.g., failure to navigate the plane back to the home ship, failure in carrier landing, etc.) were always a problem. Many squadrons lost more men through operational losses than through enemy action. Unfortunately, the records on operational losses were never sufficiently complete or readily available to enable the Aviation Psychology Branch to use operational losses as a criterion.

Evidence. Certain outside criterion data, unfortunately of a somewhat desultory nature, are, however, available with which the nomination data can be compared.

(1) There was an indication (as discussed in Chapter IV) that a relationship exists between nomination status and whether the nominee was transferred out of the squadron before the termination of the assigned tour of combat duty. These data came from an intensive study of the turnover which occurred in several selected squadrons in the combat area. It was indicated that pilots who remain with the squadron during the whole of an assigned tour of duty ("Regulars") are much more likely to be nominated High than are those who are transferred out of the squadron for one reason or another ("Floaters").[12]

(2) A similar indication resulted from the intensive analysis of data from 10 Air Groups, also discussed in Chapter IV. The Lows among pilots included only on the squadron rosters six months previous to the time nomination data were collected (i.e., who did not also appear on the second "current" roster) greatly outnumbered the Highs, whereas for the sample as a whole (all pilots on either or both rosters) the Highs outnumbered the Lows.[13]

(3) Reference to Chapter I will show that nomination data collected from pilots early in the preliminary stages of the combat criterion research yielded indications of relationship with ratings made by the Squadron Commander, and with nominations by Aircrewmen. Both of these contingencies were significant at the .01 level of confidence, and yielded contingency coefficients in the neighborhood of .50 or higher. Relationships of nomination status to the selections of the Air Group Commander, and of the Flight Surgeon

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[12]Although about the same proportion of "Regular" and "Floaters" were nominated either High or Low.

[13]The data from the 10 Air Group analysis and from the "Regular-Floater" analysis were not, however, altogether independent, some cases being common to both studies.

were somewhat less statistically significant, i.e., at the .07 level of confidence. Contingencies significant at below the .01 level of confidence were, however, obtained between nomination status and downchecks during primary training, and grades during primary and intermediate training, respectively.

(4) Moreover, there is rather clear indication (not discussed previously in this report) that nomination status is related to appearance before a Naval Aviation Disposition Board.[14] Nomination data were available for 57 men who appeared before a NADB up to September 11, 1945. Fifty-three (or 93 per cent of the group) had been nominated for Low one or more times and had received no nominations for High. The average number of Low nominations per man was 3.6, a somewhat greater number than the average for all Low nominees, which was in the neighborhood of 2.

Three men (or about 5 per cent of the group) had been nominated for High, none of these cases being before the Board for strictly medical reasons. One of the three received two nominations for High, the other two only one nomination. There was one "mixed" nomination case, who received, incidentally, 2 High nominations and only one for Low. It is striking that 53 of these 57 disposition board cases received nominations *exclusively* for Low. Although these data are not extensive they do very definitely support the argument for the validity of the nomination data.[15]

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[14] A Naval Aviation Disposition Board was a board composed of line officers and flight surgeons, convened for the purpose of deciding whether an aviator should be "grounded," i.e., be deprived permanently of his flying status. Cases could be referred to a NADB by major commanders after recommendations by Squadron Commanding Officers.

[15] It might be argued that knowledge of pending NADB actions influenced the respondent's nominations of officers for Low and that this "outside" criterion is not independent. The possibility that some contamination might have taken place cannot categorically be denied. The directive setting up the NADB was promulgated under the date of February 29, 1944, coincident with Capt. Jenkin's first exploratory work in the MA, and just over one year before the final checklist nomination data were collected. While this time lapse would allow some contamination it appears highly unlikely that such contamination, if present, was of sufficient degree to vitiate the significance of the marked preponderance of Lows (among NADB cases on whom nomination data were available) as evidence pointing to the validity of the nomination data. Although, on the other hand, the possibility of contamination cannot be set aside it is of interest to note a report from Navy personnel to the effect (a) that aviators who made the nominations in general found little difficulty in naming two Highs and two Lows, and (b) that individuals appearing before a NADB had usually seriously failed, in some manner, in the performance of their duties. It has been suggested that if individuals appeared both before a Board, and in the nomination data, there was good reason for it.

Summary Consideration of Evidence Relating to Validity

The nomination data can be considered to have a great deal of "authoritative validity" in view of the life and death nature of the situations in terms of which the nominations were made. While the club of "authoritativeness" will not suffice to beat down all criticisms of the validity of the criterion, certainly the criterion data should be considered valid unless clear evidence against such validity can be marshalled. The one, and perhaps the only, general criticism that could be raised would be to the effect that the respondents thought they were nominating men by reason of their combat efficiency whereas in actuality they were not, i.e., the nominations were actually so influenced by extraneous factors as to be generally lacking in validity.

In view of the fact that logical answers are at hand in reply to the major criticisms which might be raised in this connection and in view of the somewhat desultory, but none-the-less impressive supporting evidence in terms of "outside" criteria, it seems quite clear that arguments which might be raised against the validity of the data yielded by the nomination technique are not sufficient to support the conclusion that the criterion data are invalid.

It could not be said, of course, that no nominations were influenced by personal likes and dislikes; that no nominations were made in terms of superficial reasons; or that no nominations were unduly influenced by rank and prestige. On the other hand the conclusion is tenable that the bulk of nominations were made in terms of observed behavior pertinent to combat efficiency and that the two criterion groups, representing extremes of the distribution, are in fact differentiated on the basis of their reaction to the exigencies of the combat situation.[16]

RESEARCH ON COMBAT CRITERIA IN THE ARMY AIR FORCES

Before turning to consideration of the implications for future research yielded by the analysis of the U. S. Navy combat criterion data it is of

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[16]In line with this conclusion, a committee, delegated by the National Research Council Committee on Aviation Psychology to survey the Combat Criterion Data stated that: "In general, it appears to this committee that, all things considered, the nominating technique is a promising procedure for assembling combat criterion data. Certain limitations of relevance, bias, and convenience are recognized, but other limitations appear in any other type of criterion measure which is proposed. It is felt that the limitations of the nomination method are no greater, and perhaps genuinely less than those of other approaches. It is felt that both the method and the existing data from its use merit further study." Excerpt from report of the Committee to Study the Nominating Technique, prepared by Gardner, Eric; Vaughn, Charles L., and Thorndike, Robert L., June, 1948.

interest to note certain comparisons and contrasts between the combat criterion programs of the U. S. Army Air Force and the studies discussed in this report.

The AAF program was primarily directed toward determination of the relationship between test variables and combat performance of pilots, evaluated in terms of a large number of criteria.[17] The major divisions of criteria employed in the research were strike photo studies, administrative action studies, and rating studies. Under each category a large number of criteria were available or were developed, and their prediction by test score data determined. Few completely consistent trends in test-criterion relationships were evident, possibly due in large part to the fact that individual criterion measures proved quite unreliable. Moreover, the number of cases available on individual criterion measures was not large, being in general less than 500, and for a number of measures less than 100.

The efficiency of tests in predicting the combat criteria was evaluated in terms of trends, i.e., whether or not a predictor showed positive covariance with the bulk of the individual criterion measures. Over 400 test-criterion indices were available for fighter and bomber pilots, respectively. Arbitrarily, a test was considered to have promise if it showed positive covariance with 70 per cent of the individual combat criterion measures.

Twelve of 43 test measures met this criterion with reference to fighter pilots, and 13 others, or a total of 25 showed "predominately" positive covariance with the criterion measures. The situation with respect to bomber pilots was somewhat less clear. However, it was stated that "though this gross, over-all summarization is not precisely quantifiable in terms of probability, it is judged to be reasonably safe to conclude that these measures, accomplished at the time of selection and classification for training, were meaningful as predictors of combat effectives. Furthermore it appears that there was no appreciable hazard with regard to negative selection for combat, when the selection and classification testing batteries were formulated largely on the basis of training job analysis and training validation."[18]

It was also concluded that "... the apparatus tests appear to be the more potent of the predictors for fighter pilots; while the printed tests, and particularly those probably most heavily loaded for the measurement of 'intellectual' traits, appear to be relatively more important for the prediction of bomber pilot performance."[19]

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[17] See Lepley, William H. (Ed.), Psychological research in the theaters of war, Washington, D.C.: U.S. Government Printing Office, Army Air Forces Aviation Psychology Program Research Reports, Report No. 17, 1947.

[18] Ibid, page 105.

[19] Ibid, page 106.

TABLE 8.1*

THE RELATIVE VALUE OF THE AIR-CREW CLASSIFICATION TESTS IN SAMPLES OF FIGHTER PILOTS FOR PREDICTING COMBAT RATINGS OF EFFECTIVENESS, CASUALTIES, ACCIDENTS, AERIAL COMBAT VICTORIES, DECORATIONS, RECLASSIFICATIONS, AND TRANSFERS TO OTHER TYPES OF DUTY

Tests	Test No.	Data** Combined	Approx. No. of Cases in Combination	Combined Weighted r
Aiming Stress	CM211A	3,5,7,9,11-14	2,180	0.051
Discrimination Reaction Time	CP611D	1-14	2,700	.050
Rotary Pursuit	CM803A	3,5,7,9,11-14	2,180	.047
Mechanical Principles	CI903A, (AC10D6)***	1-14	2,700	.041
Complex Coordination	CM701A	1-14	2,700	.040
Spatial Orientation I	CP501B	1-14	2,700	.033
Finger Dexterity	CM116A	1-14	2,700	.027
Spatial Orientation II	CP503B	1-14	2,700	.025
Two-Hand Coordination	CM101A	1,3,5,7,9,11-14	2,210	.023
Dial and Table Reading	CP622-21A, (CP621A, CP622A)	1-11	1,900	.022
Technical Vocabulary (F)	CE505C	1-14	2,700	.014
Speed of Identification	CP610A	1-11	2,700	.011
Mechanical Information	CI905A	3,5,7,9,11	1,380	.011
Reading Comprehension	CI614C, (AC1)D-2)	1-11	1,900	.008
Mathematics B	CI206B, (CI710A, CI706A)	1-11	1,900	.005
Numerical Operations	CI702B	1-11	1,900	-.019
Technical Vocabulary (n)	CE505C	1-11	1,900	-.020
Mathematics A	CI702E	1-11	1,900	-.022
Technical Vocabulary (B)	CE505C	1-11	1,900	-.037

*From Table 4.7, p. 103, Flanagan, J.C. (Ed.) Op. cit.

**Studies included in combination:

	Initial survey	No. of cases
1.	Ratings by squadron officers on general over-all effectiveness ETO	11- 37
2.	Ratings by squadron officers on general over-all effectiveness MTO	20-169
	AERD No. 2	
	r biserials calculated from critical ratio data.	
3.	Personnel removed from flying status vs. matched control	47- 65
4.	Casualties vs. noncasualties, Battery No. 1	120-120
5.	Casualties vs. noncasualties, Battery No. 2	350-350
6.	Accidents vs. nonaccidents, Battery No. 1	85- 85
7.	Accidents vs. nonaccidents, Battery No. 2	366-366
8.	Victories vs. nonvictories, Battery No. 1	110-110
9.	Victories vs. nonvictories, Battery No. 2	450-450
10.	Decorated vs. nondecorated, Battery No. 1	73- 73
11.	Decorated vs. nondecorated, Battery No. 2	158-158
	AERD No. 3	
12.	Proficiency rating made by Commanding Officer, Operations Officer, Operations and Flight Surgeon	239-305
13.	Hypothetical elimination	203-263
14.	Retention vs. transfer	255-352

***The combined correlations for these tests include a composite of all of the forms indicated. The test number or numbers in parentheses constitute the smaller proportion of cases.

TABLE 8.2*

THE RELATIVE VALUE OF THE AIR-CREW CLASSIFICATION TESTS IN SAMPLES OF BOMBER PILOTS FOR PREDICTING COMBAT RATINGS, BOMBING ACCURACY, RECLASSIFICATION, ACCIDENTS AND IMPORTANCE OF POSITIONS HELD

Tests	Test No.	Data** Combined	Approx. No. of Cases in Combination	Combined Weighted r
Mathematics B	CI710A, (CI206B, CI706A)***	1-12	1,390	0.166
Complex Coordination	CM701A	1-12	1,390	.151
Mechanical Information	CI905A	10-12	590	.099
Discrimination Reaction Time	CP611D	1-12	1,270	.098
Spatial Orientation II	CP503B	1-12	1,390	.098
Reading Comprehension	CI614G, (AC10D2)	1-7,10-12	1,300	.091
Mechanical Principles	CI903A, (AC10D6)	1-7,10-12	1,300	.083
Spatial Orientation I	CP501B	1-12	1,390	.078
Technical Vocabulary (N)	CE505C	1-12	1,390	.074
Two-Hand Coordination	CM101A	1-4,8-12	940	.064
Speed of Identification	CP610A	1-12	1,420	.062
Dial and Table Reading	CP622-21A, (CP621A, CP622A)	1-12	1,420	.053
Technical Vocabulary (P)	CE505C	1-12	1,390	.053
Finger Dexterity	CM116A	1-12	1,390	.050
Rotary Pursuit	CM803A	10-12	590	.045
Numberical Operations	CI702B	1-12	1,420	.034
Mathematics A	CI702E	1-12	1,420	.033
Technical Vocabulary (B)	CE505C	1-12	1,390	.014
Aiming Stress	CM211A	5-12	1,010	-.005

*From Table 4.14, p. 111, Flanagan, J.C. (Ed.) Op. cit.

**Studies included in combination:

	Study	No. of cases
	Initial Survey	
1.	Ratings on pilots by squadron officers on general over-all effectiveness, ETO	18- 48
2.	Ratings on pilots, MTO	38-106
3.	Ratings on co-pilots, ETO	26-180
4.	Ratings on co-pilots, MTO	25- 72
	AERD No. 1	
5.	Ratings by staff personnel, 8AF	130
6.	Radial error and percent hits, 8AF, May and June 1944	100
7.	Radial error and percent hits, 8AF, July 1944	106-110
	AERD No. 2	
8.	Analysis from strike photographs of percent of bombs falling within 300 feet of target for lead pilots with 4 or more usable photos.	47- 64
9.	A converted score based on the radial error for lead pilots with three or more missions 4 biserials calculated from critical ratio data.	31- 46
10.	Pilots removed from flying status by Flying Evaluation and Reclassification Boards versus matched control, ETO.	18- 35
11.	Bomber pilots involved in pilot error accidents versus lead bomber pilots, 15AF	78-118
12.	Lead versus nonlead pilots	172-289

***The combined correlations for these tests include a composite of all of the forms indicated. The test number or numbers in parentheses constitute the smaller proportion of cases.

In addition to analysis in terms of trends, comparisons were made between test score and combinations of the various measures of combat effectiveness through combining the coefficients computed against individual measures. Such combined coefficients are presented in Tables 8.1 and 8.2, taken from Chapter IV, of the summary report on The Aviation Psychology Program in the Army Air Forces.[20] It should be emphasized, that the primary source for detailed descriptions of AAF research involving criteria of combat performance is given in Report No. 17, Psychological Research in the Theaters of War,[21] and that the materials presented here are merely brief summaries of some of the very extensive studies conducted by the AAF in the area of combat effectiveness.

Examination of Tables 8.1 and 8.2 indicates that although none of the coefficients are markedly high, due perhaps to the unreliability of the criteria, the five tests showing highest coefficients with measures of success as fighter pilots were "Aiming Stress," "Discrimination Reaction Time," "Rotary Pursuit," "Mechanical Principles" and "Complex Coordination." In predicting measures of bomber pilot success, "Mathematics B," "Complex Coordination," "Mechanical Information," "Discrimination Reaction Time," and "Spatial Orientation II" yielded the highest coefficients. It is noteworthy that the coefficients for the samples of bomber pilots were somewhat higher than for fighter pilots.

Among the many procedures used by the AAF was a technique similar to the nomination technique used in Navy studies. A number of squadron commanders and operation officers were asked to "arrange the airplane commanders in the squadron in a rank order according to over-all effectiveness in combat."[22] In a variation of this approach, these men were asked to "name the five or six pilots they would like to get rid of before the squadron went back to combat, if it were administratively possible."[23] Relationships between these measures and tests in the Air Force battery were not large, as is indicated in Table 8.3, particularly when coefficients based on more than a few cases are considered. Moreover, provision was not made for analysis of reasons for ranking or reasons for desiring transfer of certain pilots.

In general it is difficult to compare the efficiency (or lack of it) with which the combat criteria were predicted in the Navy and Army Air Force studies, respectively. Certainly, it can be said that in neither study was there general evidence of negative prediction, i.e., there was little indication that

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[20]Flanagan, John C. (Ed.) The aviation psychology program in the army air forces, Washington, D.C.: U.S. Government Printing Office, Army Air Forces Aviation Psychology Program Research Reports, Report No. 1, 1948. The tables presented above are adapted from Tables 4.7 and 4.11, pages 103 and 111 respectively in this report.

[21]Lepley, William H. (Ed.) Op. cit.

[22]Ibid, page 97.

[23]Ibid, page 100.

TABLE 8.3

CORRELATION OF CERTAIN CLASSIFICATION TESTS WITH RATINGS OF FLYING PROFICIENCY, AND "HYPOTHETICAL TRANSFER," SEVENTH AIR FORCE FIGHTER PILOTS*

Test	Correlation in Terms of			
	Flight Proficiency Rating (r_{xy})		Hypothetical Transfer Group ($r_{bis.}$)	
	r	N	r	N
SAM Rotary Pursuit, CM803A	0.07	246	0.22	210
SAM Two-Hand Coordination, CM101A	-.10	298	-.05	257
SAM Complex Coordination, CM701A	-.01	304	.10	262
Aiming Stress, CE211A	.08	239	.03	203
SAM Discrimination Reaction Time, CP611D	.11	303	.11	261
Finger Dexterity, CM116A	.04	305	.09	263
Mechanical Principles, CI903A	.06	239	.16	203
Spatial Orientation I, CP501B	.13	300	.18	260
Spatial Orientation II, CP503B	.05	301	.07	261
Biographical Data, Pilot, CE602D	.09	28	-.12	25
Speed of Identification, CP610A	-.08	301	.06	259
General Information, Pilot, CE505D	-.30	28	-.45	25
Technical Vocabulary, Pilot, CE505C	.03	276	.00	237
Pilot Stanine			.14	264

the tests, originally validated in terms of training success, tended to weed out potentially good combat pilots. On the other hand, and despite the statement that test measures in the AAF battery were "meaningful as predictors of combat efficiency"[24] it is doubtful that the AAF measures were much more predictive of combat proficiency than were the Navy measures. Somewhat more predictive value for the AAF pilot Stanine might be expected since it was based on a larger number of tests than were included in the Navy battery.

In conclusion, it can be stated with little equivocation that consideration of the indices of relationship between tests and the combat criterion measures, yielded by research in the two services, indicates that none of the tests used by either service, and devised to predict success in training, gave evidence of predicting the combat criterion measures to any marked degree. Although no substantial evidence for negative selection was evident, none of the relationships indicated that, among men completing flight training, the tests separated potentially good from potentially inferior combat aviators to a degree associated with practical predictive significance.

IMPLICATIONS FOR FUTURE RESEARCH

A number of suggestions for future research, arising from the analyses of data collected by means of the nomination technique, have been presented in pre-

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[24] *Ibid*, page 105.

*Adapted from Lepley, William, H., *Op. Cit*.

vious chapters of this report, either in specific terms or by implication. In this section previous research suggestions will be summarized, and several others presented.

Major Problem

Before this presentation, however, one major question bearing both on future research and on practical applications of the findings of this study, should be considered. With reference to this question it is assumed that (1) the criterion data are valid and that the criterion groups are clearly separated in terms of combat proficiency, and (2) the analyses of reason for nomination data indicate "observed behavior syndromes" in terms of which High and Low nominees may be characterized.

Granting these points, a critical question remains, viz: How much application will conclusions relating to combat performance, drawn on the basis of analysis of data gathered in the hostilities just concluded, have in regard to questions of combat performance under conditions of some future war? For example, and more specifically, since the missions, and conditions under which Naval aviators engage in combat in some future war might be entirely different than in the Pacific Ocean Area during the war against Japan, it might be questioned whether the qualities of Leadership, Teamwork and Practical Intelligence would be prepotent, or even whether the same configuration of observed behavior characteristics would apply. In these terms it might be argued that this combat criterion research should be considered of primarily historical and academic interest, and the desirability of continuing research, at least with the present data or along lines indicated by these analyses, open to considerable question.

Admittedly a definitive answer to the question of the degree or nature of changes in missions, combat conditions, and equipment in relation to Naval aviation in some future war is not possible. It is recognized, however, that such changes undoubtedly will occur. Nevertheless, it is felt that a more complete understanding of the implications of combat criterion data gathered in World War II can well lead to immediate applications in the evaluation of potential combat efficiency. Such developments can provide a groundwork on the basis of which modifications of procedures, designed to meet the operational changes in Naval Aviation of the future, can be made.

Therefore, research in a number of areas leading to a better understanding of the criterion, and in gearing the criterion to the needs of the future, will be outlined.

Validity Studies

Although available evidence appears to indicate that the criterion is valid, i.e., that the High and Low criterion groups are differentiated in terms of combat efficiency, certain additional research, with reference to both "external" and "internal" measures of validity might well be considered.

"**External" Measures.** Although most external criteria are not characterized by marked reliability, consideration might be given to comparing nomination status with data on "operational losses," as discussed earlier in this chapter. It has been noted that at the time the major analyses described in this report were conducted such data were not available. Inquiries might well be made at this time to determine if comparisons with these data can now be made.

Consideration might be given to comparison of nomination status with data from Fitness Reports. Such comparisons, however, might not be fruitful due to the marked limitations of these reports, as criterion data, particularly with reference to lack of reliability and marked restriction of the variance of the population in terms of criterion measures based on Fitness Reports.[25]

On the other hand analysis involving certain of the qualitative data in the Fitness Reports might be worthwhile. Fitness Reports on small samples of officers nominated High, and Low, respectively, were inspected. Although no quantitative analysis was attempted, the general impression from comments on a number of Fitness Reports was that, particularly early in the war, many young officers were placed in positions of too much responsibility for which they were unfitted in terms of experience and maturity. Several such officers who were nominated Low, and who received relatively poor Fitness Reports early in their careers, received highly commendatory Fitness Report ratings and comments later in the war. Pilots whose Fitness Report comments included variations of the descriptive phrase "Rapid improvement after a slow start" almost invariably were nominated Low.[26] In this connection studies of changes in nomination status over a period of time would be extremely informative.

It is recognized, of course, that the basis for these tentative conclusions with reference to the Fitness Reports is almost entirely anecdotal. However, additional work of a more quantitative nature relative to such comparisons between nomination data and Fitness Reports might be enlightening.

"Internal" Analyses. Certain additional analyses pertaining to internal relationships in the combat criterion data might be fruitful.

(1) Analyses might be undertaken to determine differences in nomination data, including reasons for nomination, when nominations made by respondents who were themselves Low nominees are considered in relation to nomination data from respondents who themselves were High nominees. Such analyses might

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[25]Bureau of Naval Personnel, Training, Standards and Curriculum Division, Test and Research Section, Research Unit, An evaluation of the report on the fitness of officers, July, 1945.

[26]Memorandum to M. S. Viteles, Chairman, NRC Committee on Aviation Psychology, from E. S. Ewart, Technical Aide, November 8, 1948.

well yield an indication of the degree to which nominations are affected by the status of the respondent with respect to combat efficiency, and thus provide an indication of the stability of the nomination data.[27]

(2) Analyses might be undertaken to determine which reason for nominations, or reason for nomination factors, were less susceptible to influence by extraneous factors pertaining to the nominee, such as rank, age, time of training completion, etc.

Refinement and Use of Criterion Measures

Future research on the development of criterion measures should probably pertain most directly to development of criterion instruments for use in the field, based on the insights gained through analysis of nomination data, as well as to extensions and refinements of the nominating technique itself as a field instrument.

Specific Instruments. A number of suggestions in respect to development of criterion instruments have been presented in some detail in the last section of Chapter VII (Pages 220-22). These entail the basing of rating devices, and evaluation instruments of a "forced choice" type, on the behavior syndromes as defined by the factor analyses. Moreover, development of checklists, or other devices, in terms of which both desirable and undesirable characteristics of nominees could be indicated would be of value. Again the results of the factor analyses would be pertinent. Research on such developments is undoubtedly important.

The Nomination Technique in the Training Situation. Considerable attention should be given to research bearing on the utilization of the nomination technique itself in obtaining criterion data during training, particularly during operational training. Certain steps in this direction already have been made. Use of the technique was made in a study on procedures for identifying desirable combat pilot traits at early stages of training, carried out at the Athens, Georgia, pre-flight school. The procedures used in the combat areas were modified for this purpose. The technique provided marked differentiation, and the results showed considerable correspondence to other measures. The report on this study is presented in Appendix 8-B.

Studies on nomination for leadership characteristics have been in progress at Pensacola, Florida. No significant differences between the top and bottom 20 per cent of students ranked in order of a leadership score were found in

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[27]This, and other information, with reference to two squadrons are provided by the sociometric diagrams presented in Appendix 8-A. While these data are too limited for extended analysis, the graphical presentation of respondent-nomination relationships is of interest.

terms of grades on the ACT, MCT, in the Pre-Flight Course, or in terms of athletic or physical fitness measures. Correlations between nominations from various sources similarly were not high.[28]

Overlap between Combat and Operational Criterion Measures. Important results could be obtained through directing major research toward determining the overlap between criterion data yielded by the nomination technique in peacetime operational flying and in combat situations, respectively. Findings yielded by an investigation of this sort would indicate specific areas in terms of which success in operational flying could be considered indicative of potential effectiveness in combat. Implications of such research for selection are obvious. Validation of selection instruments could be made in terms of measures of those areas of operational success which were considered common to combat effectiveness. Moreover, artificial situations might be devised, by means of which potential effectiveness in areas of the combat criterion, not routinely sampled in the operational situation, could be evaluated.

Investigations of the overlap between operational and combat situations might be set up in a number of ways. For example, assuming that the results of the factor analyses have yielded a relatively definitive indication of the structure of combat effectiveness, intensive job analyses of the operational situation might be made to determine which areas of combat effectiveness were not covered. Again, factor analyses of reason for nomination data collected in operational flying might be made, and compared with the results of the factor analyses of combat data.

Effect of Modifications in the Nominating Technique. Furthermore, certain other projects directed toward development of changes in the technique might well be suggested, for example investigations of the effect of wording of instructions given to elicit nominations. Attention might be focused on developing instructions which would free the nominations as much as possible from the general "popularity element."[29] In view of the possibly distorting influence of implicitly defining High nominees as "Senior" officers, and Low nominees as subordinate officers, as was the case with the combat nominations, it might well be recommended either that this phraseology be permanently discarded, or that the restriction be imposed that nominees are to be of the same rank as the respondent.

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[28] Memorandum to Captain Wilbur E. Kellum (MC) USN, from Howard E. Page, Training Analyst, Naval Air Training Command, U. S. Naval Air Station, Pensacola, Florida, August 10, 1948.

[29] It has been suggested that this might be accomplished by simultaneously obtaining ratings based frankly and explicitly on popularity, and determining the wording of questions eliciting nominations of "combat effectiveness" which would show a minimum overlap with the "popularity" nominations. See Report of Committee to Study Nominating Technique, op. cit.

The Nominating Technique as an Administrative Device. Much thought has been given to the use of the nominating technique as an administrative device. This would imply, of course, that the nomination data would not be considered confidential and for research purposes only, but rather that, while the identity of individual respondents would, of course, be confidential, the nomination status of each individual in the group in question could be used as a basis for administrative action.

In connection with the "Athens Study" described in Appendix 8-B, certain objections have been raised against attempts to use the nomination technique in this manner, based primarily on the considerations that there is no evidence that nomination status would remain constant through training, that fellow cadets are inadequate judges, and that the procedure is "inconsistent with the fundamental principles of military organization and Naval command."

These objections represent, in part, fruitful topics for research, particularly with regard to investigations of (1) changes in nomination status as individuals progress through training, and (2) relationships between nomination data from cadets and from other personnel, in particular their superior officers. As noted previously, these latter relationships, evident in work done at Pensacola, were not particularly high.

The most critical question in connection with use of the technique as an administrative tool is, of course, determination of how nomination data are affected when it is known, as a condition of the collection of the data, that the nomination status of the nominees will not be confidential, but will be a basis for administrative action. It would seem that research on this important problem should have high priority, and should precede use of the technique in an administrative connection.

Other Considerations. It should also be recognized that nomination data collected in the field, for administrative purposes or solely in connection with research, can be used as a criterion measure against which other criteria can be checked. For example some preliminary analyses of early combat nomination data showed that they corresponded relatively closely to ratings made by superior officers (contingency coefficients of .4 to .6). Further evidence on this overlap might be obtained by studying nominations obtained during fleet operations and relating them to UBAG ratings on the same personnel.

If the correspondence with UBAG ratings were found to be high, the UBAG ratings might be found more feasible, from an administrative standpoint, than the nomination technique. In this connection more critical studies of the UBAG ratings, and their adequacy as combat criterion data, might well be considered.[30]

The Combat Criterion in Future Hostilities. In the event of future hostilities it would appear desirable to initiate collection of combat criterion data early in the proceedings, possibly as administrative data if con-

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[30] These suggestions were presented in the report of the Committee to Study the Nominating Technique, referred to earlier in this Chapter.

ditions warranted, or for use as soon as possible in refining selection and classification procedures. In this connection the background provided by these analyses of the combat criterion data collected during World War II, and continuing studies on the nominating technique, would provide a sound basis for development of procedures applicable to whatever combat conditions might prevail. As noted in the previous chapter, the analysis of reasons for nomination, and the factor analyses of these data, provide bases in terms of which rating scales, more discriminating and more easily administered checklists, or other instruments could be constructed. It was suggested, for example, that the factors isolated by the factor analyses could be used as a basis for the construction of a much abbreviated checklist of reasons for nomination. Research should be initiated investigating the utility of abbreviated checklists based on these factors.

Selection

The original purpose of the combat criterion program was the development of a criterion for use in the validation of selection tests. Through such validation, instruments could be made available for use in the prediction of success in air combat. Selection of combat effectives represents, of course, an extremely important supplement to selection of training passers.

Much of this report has been concerned with the implications of research bearing on the nature of combat efficiency *per se*. Such research is of utmost importance, of course, since definition of a reliable criterion is a necessary condition for the development of effective selection devices. Nevertheless, the specific implications of the research for selection test development cannot be emphasized too strongly.

Research Utilizing Data Already at Hand. Several suggestions have been made previously in this report (Chapters VI and VII) with reference to additional research on the prediction, by tests in use between 1941 and 1945, of the combat criterion data collected during World War II. The most pertinent of these suggestions concerned prediction of reason for nomination, in particular by the Biographical Inventory. Specifically, it was suggested that "Factor Scores" be computed for each nominee on the basis of the reasons used for his nomination, and the differential prediction of reason for nomination factors (or observed behavior traits) determined. These reasons for nomination criteria might prove more pure than mere general nomination for High or for Low, and not only be susceptible to better prediction than the more gross criterion, but in addition provide more meaningful prediction.

Advisability of such research involving the B.I. is open to certain major objections on practical grounds. The version of the Biographical Inventory used in the last war may, perhaps more than other tests, be completely inapplicable to populations selected in the future. It is very probable that the predictive utility of personal history and "personality inventory" data of this sort may not generally be maintained over a long period of time, since slight modifications in culture patterns, for example, necessitate continued revision of such instruments.

Nevertheless, additional evidence on the utility of the Biographical Inventory, and other tests, in predicting more refined "reason for nomination" breakdowns in terms of the combat criterion data already at hand would seem to be of basic importance, as fundamental knowledge, to test development leading to the selection of combat effectives in the event of future hostilities. That is, the possible utility of such instruments in predicting reason for nomination should be more fully explored. Thus more definitive studies on prediction of reason for nomination, in terms of the World War II data, may well be desirable.

It might also be desirable, as suggested by the Committee to study the Nominating Technique, to make a critical study of the criterion data from Multi-engine squadrons, in the same terms as the intensive study of data from 10 carrier-based air groups was conducted. Some guide might be provided as to the appropriateness of the criterion as applied to the selection of pilot personnel who work together less closely than do carrier based squadrons.

Development of New Selection Instruments. Although further research utilizing tests in the regular battery is undoubtedly advisable, without question an even more urgent need is the development of new selection instruments for the prediction of combat effectiveness. In this connection, the isolation of the elements of combat effectiveness, as yielded by the factor analysis, has important implications. Research should immediately be oriented toward the development of tests predictive of behavior associated with the areas of combat performance, e.g., Leadership, Teamwork, Practical Intelligence, etc., known to be important on the basis of the factor studies.

It is recognized, of course, that tests developed to predict behavior in certain areas may actually turn out to yield better prediction in other areas. It is recognized that changes in Naval Aviation may require modification of the pattern of behavior characteristics important to combat effectiveness in the last war. Nevertheless development of new tests for the prediction of combat effectiveness is of prime importance, and the factor pattern yielded by the analysis of reason for nomination data supplies a very suitable frame of reference in terms of which such a program of test development can be initiated.

Data on proficiency in training, or in operational peacetime flying, yielded by adaptations of the nomination technique to these purposes can be used in the validation of new selection instruments as discussed in a previous section of this chapter. Modifications of the nominating technique are, in fact, being used at present to yield criterion data for validation studies currently being conducted.[31]

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[31]Under the direction of Verne W. Lyon, Commander, MSC, USN, Director of Research for the Chief of Naval Air Training, Naval Air Station, Pensacola, Florida. Analyses of these data will not be made for about one year, at which time criterion data will be available.

Methodological Implications. With reference to all selection research, and particularly with respect to extensions of the analyses already conducted on the World War II combat data, the importance of dealing with homogeneous, rather than heterogeneous samples, has been clearly indicated and cannot be overemphasized. Although statistical control can be utilized to correct for the effect of extraneous factors, such as rank, it seems likely that reliance also on experimental control, through treating homogeneous samples, is productive of more unequivocal results.

Other Investigations

A number of other investigations, not clearly categorized in terms of the sections above have, or might be, suggested. For example, attempts might be made to follow up the subsequent careers in the Navy of the men included in the criterion group. Information on changes of squadron, actions by the Naval Aviator Disposition Board, accidents, decorations, promotions and the like might throw some further light on the attributes of High and Low nominees.[32] Moreover, an intensive personality analysis including psychiatric examination of a sample of High and Low nominees who could be located for such purpose might be made. However, in view of the fact that such appraisals of the men would take place 4 or 5 years after the nominations were made and 7 or 8 years after original selection for pilot training might make such research inadvisable. Personality growth and change during that period might render the outcomes of the study meaningless.

In general, however, the factor analyses of reason for nomination data has yielded considerable in the way of "clinical insights" into the nature of combat effectiveness and the lack of it. The value of these insights for studies of leadership, combat fatigue, and related subjects has been mentioned elsewhere in this report but should again be emphasized.

SUMMARY:

DETAILS OF AN INTEGRATED RESEARCH PROGRAM

In summarizing this final chapter, which in itself represents in part a recapitulation of the entire report, it seems desirable to outline briefly certain major research activities mentioned previously in this chapter, directed toward development of tests predictive of combat effectiveness, and further definition of the combat criterion.

Activities in such a program can be classified under three major rubrics: (1) test development, (2) criterion development for immediate research pur-

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[32] Rather informal analysis of data from a sample of nominees has suggested that the incidence of Lows among pilots remaining in the Navy after the War may be greater than in the case of Highs. A more definitive study of this point might be of interest.

poses, and (3) development of other applications of the criterion measures. Activities under these three classifications are, of course, interrelated. New tests cannot be validated until adequate criteria, associated with behavior pertinent to combat effectiveness, are available. Moreover, criterion development for immediate research purposes has implications for development of other applications of the criterion measures. The above classification is necessary, however, for purposes of organization.

Test Development. Immediate steps should be taken toward the development of test instruments predictive of behavior associated with the areas of combat performance identified by the factor analyses. Particular emphasis should be given to tests associated with those areas indicated as most important in combat effectiveness, viz: Leadership, Teamwork, Practical Intelligence, and Combat Aggressiveness. The implications of the superordinate classifications of behavior characteristics as revealed by the second order factor analyses should also be considered. Validation should be accomplished in terms of criterion measures discussed below. This is perhaps the most important implication for future research.

Consideration should also be given to the desirability of conducting additional analyses, utilizing combat criterion data collected during the last war, in providing a background in terms of which current work can be oriented. One major investigation might comprise more refined analysis of the prediction of reason for nomination, particularly in terms of the Biographical Inventory.

Criterion Development for Research Purposes. The primary purpose of criterion development considered under this classification is in connection with validation of selection instruments. The following studies, among others, can be suggested:

1. Determination of the overlap between (a) behavior characteristics in terms of which effectiveness in peacetime "operational" flight or advanced training activities can be defined and (b) the behavior characteristics essential to combat flying. Determination of this overlap might be made:

    (a) through extensive job analysis of operational peacetime flying activities, and comparison of results yielded by this work with the structure of combat effectiveness as revealed by the factor analyses.

    (b) factor analysis of reason for nomination data collected in operational flying, and comparison of factors isolated with the factors yielded by the analyses of combat data.

2. Development of criterion measures in terms of which effectiveness in "operational" flight activities, and potential combat effectiveness can be assessed.

(a) Research should be initiated toward the development of means for assessing performance in those areas, related to combat effectiveness, which are not normally assessed in connection with evaluation of efficiency in peacetime "operational" flying. Such measures would represent excellent selection devices in themselves, in addition to their use as criteria for test validation.

(b) In this connection studies of the application of the nomination technique during training, and during operational exercises at sea, should be made, and practical criterion instruments developed.

(c) Modifications in the nominating technique procedure should be explored.

(1) The effect of changes in the phraseology of questions used to elicit nominations should be investigated. The results of the present study, for example, indicated that the phraseology of the questions used to elicit nominations introduced extraneous variables associated with rank. This particular phraseology[33] might well be discarded. An alternative solution would be to restrict the nominations to officers of specified ranks.

(2) More concise instruments for obtaining reason for nomination data might be developed. In this connection the results of the factor analyses discussed in this report have important implications. The phraseology of the checklist might be revised with profit.

(3) Development of nomination procedures less affected by popularity, and other extraneous considerations, would be advisable.

(d) Development of rating scale procedures, for use in those situations where such procedures are more applicable than the nominating technique, might well be considered. For research of this type the analyses of reason for nomination data have important implications.

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[33] In terms of which High nominees represented men "on whom the respondent would like to fly wing"; Low nominees, men "whom the respondent would not want flying wing on him."

With reference to all of these investigations, certain additional analyses of World War II combat criterion data would yield valuable background information. Among these investigations might be additional studies of the validity of the nomination data, through comparison with "outside" criteria now available; and studies of the effect of the nomination status of the respondent himself on his nominations. This latter study would yield further information on the stability of the nomination data, in addition to having important theoretical implications.

Other Applications of the Criterion Measures. There are two other areas in which research and related activities should be conducted.

1. Use of the Nominating Technique as an Administrative Device. If it appears feasible, from the point of view of policy, to use the nominating technique as an administrative device, studies should be made to determine the effect on nominations of the respondent's knowing that his nominations will not be used for research purposes only, but will be used as a basis for administrative action. Moreover, research might be undertaken bearing on certain objections to the use of the technique administratively. For example investigations might be directed toward determination of (a) changes in nomination status over a period of time; (b) relationships between nomination data from cadets and from other personnel, etc.

2. The Combat Criterion in Case of Future Hostilities. Finally, administrative procedures should immediately be set up to make possible collection of combat criterion data in the early stages of any future war, for use in refining selection and classification procedures, or in other connections. In this regard, the results of research, outlined above or elsewhere in this report, directed toward improvement of the procedures, such as through providing more concise and pertinent procedures for indicating reason for nomination; reduction of effect of extraneous factors; etc., would be extremely pertinent.

Conclusion. The major purpose of the research program, outlined above in rather broad terms and in more detail earlier in this chapter is the development of tests predictive of combat effectiveness. There are two aspects of the attack on this problem: test development and criterion development. Although availability of a reliable criterion is a necessary condition for establishing test validity, work on both aspects of the problem can be conducted simultaneously.

Research in this area represents pioneering endeavor. Nevertheless, advances in the development of a program directed toward selection for proficiency in combat, and the insights into the nature of combat efficiency provided by combat criterion research, can have an important immediate and practical influence on maintaining, and increasing, the effectiveness of Naval aviation in the face of whatever contingencies the future may present.

APPENDIX I-A

COPY OF MEMORANDUM INITIATING WORK ON CLASSIFICATION OF NAVAL AVIATORS FOR SPECIAL TRAINING BY AVIATION PSYCHOLOGY BRANCH

APPENDIX 1-A

NAVY DEPARTMENT

QR5/P11-1 (C84-40
BUR. M. & S.

Refer to No. Aer-TR-2-MHA BUREAU OF AERONAUTICS
P11-1
OV4-MVl WASHINGTON 1943 26 JUL

NAVY DEPARTMENT
24 JUL 1943

114-09

From: The Chief of the Bureau of Aeronautics.
To: The Chief of the Bureau of Medicine and Surgery.

SUBJECT: Classification of Naval Aviators for Specialized Training.

1. Since it is no longer feasible to give all types of specialized flight training to all Naval Aviators, it is desired to classify aviation cadets according to the specialization in which they are likely to be of greatest value to the Navy.

2. Classification at present is largely on the basis of the cadet's expressed preference. While this is felt to result in a somewhat better classification than would result from chance, it is believed that more satisfactory procedures can be developed.

3. It is requested that the Aviation Psychology Section be authorized to begin a study of the subject problem and develop practical classification procedures as soon as possible. This Bureau will provide facilities and supplies but requests that personnel and technical direction be furnished by the Bureau of Medicine and Surgery.

4. The need for this project was discussed at the recent training conference and is further emphasized in correspondence from the Naval Air Intermediate Training Command.

5. It is anticipated that this project will be carried out at both Intermediate and Operational Training Bases.

6. As with other psychological test procedures, practical use of any procedures developed on this project will be made only after satisfactory cross-validational studies have been completed.

Copy to:
CNAOT
CNAIT

RALPH DAVISON
Rear Admiral, U. S. N.
Acting Chief of Bureau

APPENDIX 1-B

SUMMARY OF STATEMENTS DESCRIPTIVE OF PILOTS NOT WANTED IN COMBAT AREA

(Based on 500 responses obtained by Lt. F. A. Webster)

APPENDIX 1-B

I. THE INDIVIDUALLY POOR PILOT, who

3. lacks basic flight skills
4. does deliberately dangerous flying (flat-hatting, etc.)
18. is poor in instrument flying, navigation, bombing, gunnery
19. doesn't know his airplane
25. lacks the desire to fly
26. dislikes radical maneuvers or close formation flying
32. is rough on the controls
36. abuses his airplane

II. THE POOR TEAMWORKER, who

1. is unreliable, undependable, erratic
2. is wilfully noncooperative
8. rejects suggestions or authorized instructions
17. looks out for his own hide too much
24. is not a good naval officer
33. lags in formation
37. dislikes his classification

III. THE SOCIAL MISFIT, who

6. does not get along with his squadron-mates
13. has alibis for his failures
14. overestimates his own skills or abilities
21. makes excessive claims for his own achievements
23. does not have squadron functions as a central interest
31. is immature
34. does not take his work seriously
38. tries to get ahead at expense of others
39. is an eager beaver; too eager to perform well
40. is lazy, indolent, or indifferent
41. is an excessive drinker

IV. THE MAN NOT ADEQUATE TO COMBAT, who

5. is nervous, jittery
7. avoids or evades combat
10. breaks down when the going is tough
11. lacks courage
16. cannot vary to meet new situations
22. is over-cautious
27. lacks self-confidence
28. uses poor tactics and doesn't follow air discipline
35. lacks initiative, agressiveness

V. THE MAN WITH POOR HEADWORK, who

9. lacks judgment, common sense
12. is not intelligent
15. fails to profit from instruction
20. dopes off in the air
29. 'is always pulling Dilberts'
30. is slow in reacting or thinking

Alternative Sixth Group

VI. THE POORLY MOTIVATED MAN, who

23. has not squadron as central interest
25. lacks desire to fly
26. dislikes radical maneuvers
34. doesn't take his work seriously
40. is lazy, indifferent

APPENDIX 2-A

EXAMPLE OF PRELIMINARY LIST OF CATEGORIES AND ANTONYMS

EXAMPLE OF PRELIMINARY LIST OF
CATEGORIES AND ANTONYMS

1. This man's flying behavior is predictable and dependable; he does what his squadron mates expect him to do at all times.

   Ant: This man is erratic, undependable, and unpredictable in his flying. His squadron mates say that they find it is difficult to tell what he will do next in any given situation.

2. This man is an excellent teamworker. He coordinates his actions with those of others.

   Ant: This man persists in individualistic, non-cooperative flying. He does not fit into the team to produce the best results.

3. This man is an excellent plane handler. His basic flying skill is exceptional.

   Ant: This man fails to come up to the minimum level of flying skill required of any combat aviator.

4. This man never deliberately flies in such a manner as to endanger his squadron mates unnecessarily, himself, or the personnel aboard his aircraft.

   Ant: This man deliberately flies in such a manner as to endanger unnecessarily his squadron mates, himself, or the personnel aboard his aircraft.

5. Under normal circumstances, this man is calm, cool, and even tempered.

   Ant: Even under normal conditions of flying, this man is unstable, nervous, flighty, and excitable.

6. This man has a pleasing personality, and makes friends easily.

   Ant: This man is one of the most unpopular men I have known. He is shunned by other pilots.

7. This man is always anxious to go on hops and strike at the enemy. When in combat he is aggressive and presses home the attack.

   Ant: This man deliberately avoids or evades combat. He may feign illness, report unauthenticated engine trouble, "get lost," or directly refuse to accept a combat mission.

8a. This man takes criticism and suggestions well. He is constantly trying to improve himself by profiting from the experience of others.

Ant: This man rejects suggestions and criticism by others.

8b. This man never refuses to carry out authorized orders.

Ant: This man refuses to carry out authorized orders.

9. This man's judgment, even in critical situations, is almost invariably correct. He displays smart headwork.

Ant: This man is poor at "sizing up" situations in the air. His decisions in a complex situation are frequently unwise or inadequate. He is frequently described as showing poor judgment.

10. This man remains cool in a crisis. He never seems to get excited in emergencies.

Ant: Although this man may do well under favorable circumstances, he tends to fail when put under pressure. Under adverse circumstances, he may "blow up."

11. This man displays all the courage necessary for military aviation.

Ant: This man lacks the basic degree of courage required in military aviation. He may be afraid of enemy action, of weather conditions, or of other dangerous situations.

12. This man's effectiveness as a naval aviator is materially increased by his high degree of general intelligence.

Ant: This man appears to lack the basic general intelligence required in a combat pilot.

13. If this man ever makes a mistake, he will be the first to admit it, instead of blaming it on somebody else or on his plane, the weather, or other factors.

Ant: This man tends to blame others for his shortcomings or to offer alibis and 'reasons' for his errors in judgment or performance.

14. This man is a 'hot pilot' in the best sense of the term. Besides being an excellent flyer, he is so modest about his ability that he wins the complete admiration of his fellow pilots.

Ant: Although he does not really have any high degree of flying skill, this man flies in such a way as to show that he thinks he is a 'hot pilot'. He is willing to attempt maneuvers which lie beyond his present range of ability.

15a. This man always 'gets the word'.

Ant: This man often fails to 'get the word'. He tends to forget what he has been assigned to do.

15b. This man learns quickly and profits from the instruction given him.

Ant: This man fails to profit from instruction. He may accept instruction willingly enough but he does not improve at a rate which will allow him to keep pace with his fellows.

16. This man takes appropriate action when it is necessary to depart from prearranged plans or prescribed procedures.

Ant: Although this man may do well in the performance of his duties which fit in with a prescribed formula, he fails to realize when it is required that he vary his procedure to meet a novel situation.

17. Always has in mind the safety of his division and places it above his own safety. In combat operations will always help someone in trouble.

Ant: This man tends to protect himself in combat, even at the expense of his squadron mates or crew. In combat operations, he looks out for NUMBER ONE.

18a. Navigation precise. Always knows his position and can strike a target or make a rendezvous at the exact time designated.

Ant: This man is described as unsatisfactory in navigation, bombing, gunnery, or instrument flying.

18b. Instrument work in bad weather is tops.

Ant: (NONE)

18c. Bombing or gunnery unusually accurate. Makes excellent approaches to the target.

Ant: (NONE)

19a. Knows his plane limitations. Makes it a point to know all about the plane he is flying. Keeps up on technical data regarding his plane.

19b. Knows a lot about the construction of aircraft and the theories of operation and engineering.

19c. Knows all types of control and instrument settings for best performance under varied conditions.

Ant: This man does not know his airplane. He fails to exhibit adequate knowledge of its inherent limitations and strong points. He may be unacquainted also with instruments, special equipment, or placement of accessory controls.

20a. Always alert to what is going on around him. Always knows exactly what he is doing. Has good eyes for other aircraft while flying. Always keeps in touch with his flight.

20b. Always alert and quick to take advantage of the enemy's mistakes.

Ant: This man is described as 'always doping off'. That is to say, he becomes inattentive or abstracted while flying. He fails to pay keen attention to important variables in the changing flight situation. (Individual does not react).

21a. Usually hits the target with more accuracy than he reports to intelligence. Conservative in his claims of combat success.

21b. A sensible man with modest habits. He never makes exaggerated statements and never makes any pretense of unusual prowess.

21c. Wants his flight to be the best, not for personal glory, but in order to secure commendation for all. Wants his squadron mates to get all the credit due them. Is less interested in himself.

Ant: This man claims unauthenticated hits or tells improbable and unsubstantiated stories about his prowess.

22. This man is aggressive in his flying against the enemy. He can be depended upon to press home the attack.

Ant: While this man is not described as yellow, he is always so cautious in his performance as to reduce his military usefulness.

23. This man takes a considerable interest in the problems of the other members of the squadron. The squadron seems to be his central interest.

Ant: Where other members of the squadron spend much time discussing tactics, flying and other concerns of naval aviation, this man fails to exhibit any primary interest in such matters. The squadron is not a central interest with him.

24. This man enjoys flying intensely. He seems happiest when he is in the air and is always anxious to take any kind of a hop.

Ant: This man is basically lacking in desire to fly. He has poor motivation for aviation in any of its forms.

25. Probably is no antonym which would be meaningful, but if such are discovered in the data the following definition might apply: "This man is always ready to try maneuvers. He seems happiest when flying tight formation or when performing some radical maneuver.

<u>Ant</u>: Although this man may like flying, he has a definite aversion for acrobatics or for tight-formation flying.

26. Although he is not cocky, this man is supremely self-confident and is firmly positive in his manner and ideas.

<u>Ant</u>: This man lacks confidence in his own abilities to such an extent as to reduce his military usefulness.

27a. This man shows outstanding tactical skill in putting his group into the best position for attack and retirement. He takes advantage of cloud cover, areas of weak resistance, variations in attack plan, and evasive tactics to effect maximum damage with minimum damage to his men.

<u>Ant</u>: This man is guilty of poor and inadequate tactics for one of his training and experience. He can be relied on to make a wrong approach on the target, stay behind when he should scissor, or violate other doctrines in tactics.

27b. This man's air discipline is exemplary. He knows and obeys the rules of the air even under the most trying circumstances, not only in formation flying but also in landing and taking off and in communications.

<u>Ant</u>: This man either does not know or disregards the meaning of air discipline. He may be out of formation habitually, fly erratically, or disregard landing or communications procedures.

28. This man is remarkably efficient in using what ability, skills, and knowledge he has. He never commits a Dilbert. If he does make a mistake, it is not because he has overlooked or forgotten something he should know.

<u>Ant</u>: This man is always pulling "Dilberts". He makes stupid blunders not expected of a pilot with his experience.

29. This man thinks and acts fast.

<u>Ant</u>: This man is simply so slow in thinking and acting as to be a liability to the squadron.

30. This man is exceptionally mature. He is self-sufficient, yet friendly, social, and considerate of others.

Ant: This pilot is described as being immature. He has an infantile outlook, and is too young emotionally to be a military pilot. He is selfish, has to be coddled and pampered, or perhaps has not yet been weaned from his home.

31. This man is described as being smooth in his flying.

Ant: This man is described as being rough in his flying or rough on the controls.

32. This pilot is described as always being where he should be in formation.

Ant: This pilot is described as lagging in formation or being unable to hold his position in formation.

33. This man is described as having a seriousness of purpose that makes him outstanding.

Ant: This man is described as not being serious, as taking his assignment too lightly.

34. This pilot is described as showing initiative.

Ant: This pilot is described as lacking in initiative.

35. Knows his plane and its limitations.

Ant: This man deliberately overextends his airplane, "beating it up" and imposing stresses and strains which are known to be beyond those reasonably expected of it.

36. (NONE)

Ant: This man dislikes his classification as fighter, bomber, P-boat pilot, etc., and would much prefer a different classification.

37. This man shares the credit with his mates. He is willing to do the inconspicuous job for the good of the group and attributes success to teamwork.

Ant: This man plays to the grandstand. He's after all the medals and publicity he can get and takes all the credit to himself.

38. (NONE)

Ant. This man tries too hard. He's so anxious to do a good job that he's tense and anxious and does a poor job.

39. This man does his full share of the work. He's conscientious and gets his job done whether it's unpleasant or not.

Ant. This man is indifferent and lazy. He'll soldier if he can and let the other fellow do the dirty work.

40. This man may do some social drinking but he keeps his head about it and doesn't mix alcohol with airplanes.

Ant. This man drinks too much.

41. This man accepts responsibility. Not only will he volunteer for special jobs but will always complete any job given him and to the best of his ability.

Ant. This man rejects responsibility. He will seldom volunteer for a job and if assigned a task is likely to pass it along to someone else or may fail to go to work on it.

42. This man, in spite of the stress of battle, has retained his mental and/or emotional stability.

Ant. This man has broken under the stress of battle conditions and is no longer psychologically suited for combat duty. (Actual record in combat may or may not have been satisfactory).

43. This man has a high regard for the welfare and feelings of his crews and his behavior toward them is exemplary of that regard.

Ant. This man's behavior and attitude toward his crews is one of lack of consideration for their welfare and feelings.

44. This man is quiet, reserved, seldom refers to himself, and is generally known as a soft-spoken man.

Ant. This man is conceited, cocky, arrogant, overbearing, etc. He is so described because of blustering verboseness, his references to "I", the dwelling on his personal experiences, his "know-it-all-attitude," etc.

45. This man is described as knowing the duties of his crewmen as well as his own; he has operating knowledge of special equipment handled by the crewmen (such as radar, identification, etc.) and by this knowledge he can get a higher level of performance from his crew than a less well informed pilot.

<u>Ant</u>: (This is high antonym of 18, #18 should be modified).

46. This man is an experienced pilot.

<u>Ant</u>: This man is so inexperienced that I would not care to have him on my wing. While he may become a good combat pilot, he should never at this time have been sent to the combat area.

47. This man is described as making sure that each man knew what he was to do and what was going to happen, as seeing that his men had the word, as briefing each man thoroughly and making each man understand what was expected of him.

<u>Ant</u>: This man failed to inform his men; he paid little attention to the briefing, and did not check to see if anyone else had the word.

48a. This man, as the leader, will do anything that he expects others to do; he will take his share of the tough jobs.

<u>Ant</u>: This man lets other people take the tough jobs.

48b. As the leader, this man would fly even when he didn't have to; he felt it was his responsibility to share all risks with his men.

<u>Ant</u>: This man used his position of leadership to avoid hops in several cases.

49. This man feels deeply the cause for which he is fighting, with a real sense of patriotism.

<u>Ant</u>: This man has little appreciation of the larger values or goals for which this war is being fought.

50. This man thought and planned ahead of time, reviewing situations which might later come up, and seldom being at a loss for what to do in an emergency.

<u>Ant</u>: This man does not plan ahead.

51. This man is a helpful teacher and takes pains to train the men as carefully as possible, allowing junior officers to practice for positions of greater responsibility.

<u>Ant</u>: This man does not take enough responsibility for training his men by passing on his experience to them or giving them a chance to practice new jobs.

52a. When placed in a position of responsibility, the man takes a personal interest in his men, shows concern for their welfare, and will fight for them if necessary.

<u>Ant</u>: When placed in a position of responsibility, this man shows little concern for their welfare, fails to get to know them, and will not stand up for their interests.

52b. This man leads his men by getting and holding their cooperation by example, persuasion and discussion.

<u>Ant</u>: This man is even-fisted and harsh in dealing with his subordinates; he is not a natural leader.

53. This man stays around to get a clear picture of the amount of damage resulting from the mission and gives a good summary on return to his base.

<u>Ant</u>: This man fails to find out what happened on the mission and his reports on return are of little value in estimating the damage done to the enemy.

54. This man is described as fair, just, or impartial in the discharge of his responsibilities as an officer. He plays no favorites.

<u>Ant</u>: This man tends to play favorites and shows partiality in discharging his responsibilities as an officer.

55. This man is described as good officer, in that he runs a "taut ship", is strict and impatient with excuses or alibis.

<u>Ant</u>: As an officer this man tends to be lax and careless in dealing with his men, so that they are poorly disciplined and casual.

APPENDIX 2-B

CATEGORIES FOR CLASSIFICATION OF FREE RESPONSE MATERIAL
(10-9-44)

APPENDIX 2-B

1. *P. This man is primarily a teamworker rather than an individualist.

   *N. This man persists in individualistic, non-cooperative behavior. He does not fit into the team to produce best results.

2. P. This man's basic flying skill comes up to the level expected of combat pilots.

   N. This man fails to come up to the minimum level of flying skill required of combat pilots.

3. P. This man does not fly in a manner which unnecessarily endangers himself or other personnel.

   N. This man deliberately flies in a manner which unnecessarily endangers himself or other personnel. He may abuse his plane, extending it beyond its known limits.

4. P. This man meets combat requirements in aggressiveness, self-confidence, courage, and willingness to press home the attack.

   N. This man fails to meet combat requirements in at least one of the following: aggressiveness, self-confidence, courage, or willingness to press home the attack. He may be called over-cautious.

5. P. This man takes criticisms and suggestions well.

   N. This man tends to reject criticisms and suggestions. He is cocky, conceited, and has a 'know it all' attitude.

6. P. This man sizes up situations well in the air; uses effective tactics, varying them appropriately when necessary to depart from a pre-arranged plan.

   N. This man is deficient in one or more of the following: sizing up situations in the air; using sound tactics; or varying his procedure when required.

7. P. This man remains cool and unexcited in emergencies.

   N. Although this man may do well in favorable circumstances, he tends to fail when put under pressure. In adverse circumstances he may blow up.

---

*P = Positive

*N = Negative

8. P. This man makes plans ahead of time, reviewing situations which might later arise.

N. This man does not adequately think ahead. He fails to review situations which might arise.

9. P. This man freely admits own errors.

N. This man tends to blame others for his shortcomings or to offer alibis and 'reasons' for his errors in judgment or performance.

10. P. This man does not overestimate his own flying skill.

N. This man overestimates his own flying skill. He is willing to attempt maneuvers which lie beyond his actual range of ability.

11. P. This man ordinarily 'gets the word' as to his assignment. He also learns quickly when given instruction and practice.

N. This man often fails to 'get the word'. He does not understand his assignment or he fails to remember it. When under instruction, he fails to learn at a rate which will allow him to keep up with his fellows. He lacks intelligence.

12. P. This man is efficient, thorough, and careful in the performance of his duties. He does his full share of the work.

N. This man tends to be slipshod, careless, or inefficient. He may be described as indifferent or lazy. Rejects responsibility.

13. P. This man keeps in mind the safety of all personnel for whom he is responsible. In combat operations, he helps those in trouble.

N. This man is overly interested in his own safety in combat, even at the expense of his squadron mates.

14. P. This man has a good knowledge of navigation, aerology, theory of flight, aircraft construction, engines, etc.

N. This man is deficient in one or more of the following: navigation aerology, theory of flight, aircraft construction, engines, etc. He may also lack adequate knowledge of instruments, special equipment, or placement of controls.

15. P. This man is good at bombing or gunnery.

N. This man is poor at bombing or gunnery.

16. P. This man is alert to what is going on around him.

N. This man is not alert to what is going on around him. He tends to 'dope off'.

17. P. This man's combat reports are ordinarily accurate.

N. This man claims unauthenticated hits or tells improbable and unsubstantiated stories of his prowess in the air.

18. P. This man gives instruction well. In briefing he gets across to his personnel what they are to do.

N. This man fails to get across to others what is expected of them. He would not make a good teacher.

19. P. This man is fair to his subordinates. He shares their risks, is willing to do what he expects of others, does not play favorites.

N. This man is regarded as unfair to his subordinates. He either fails to share their risks, or asks them to do what he is unwilling to undertake, or plays favorites.

20. P. This man takes a personal interest in his subordinates, helps them with their problems, and is not regarded as overbearing or tough.

N. This man fails to take a personal interest in his subordinates or their problems. He may be regarded as overbearing or tough.

21. P. This man enjoys flying military aircraft.

N. This man either lacks desire to fly military aircraft or exhibits a dislike for aerobatics or close formations.

22. P. This man exhibits the knowledge, skill, and correctness of performance expected of a man of his experience.

N. This man is always "pulling Dilberts". He makes stupid errors not expected of a man of his experience.

23. P. This man thinks and acts fast.

N. This man is so slow in thinking or acting as to be a liability to the squadron.

24. P. This man is mature in outlook and manner. He takes his duties seriously.

N. This man is immature in outlook and manner. He does not take his duties seriously.

25. P. This pilot shows initiative.

N. This pilot lacks initiative.

26. P. This man shares the credit with his squadron mates.

N. This man plays to the grandstand. He is after all the medals and publicity he can get. He takes all the credit himself.

27. P. Not stated.

N. This man tries too hard. He is so anxious to do a good job that he becomes tense or anxious and does a poor job.

28. P. Not stated.

N. This man drinks too much.

29. P. This man has stood up well under battle-stress.

N. This man has broken under battle-stress and is no longer suited to combat duty. (Record may have been good or bad)

****

100. P. This man dependably maintains his position in formation.

N. This man is erratic, undependable. He fails to maintain his position in formation through failure of air discipline, laziness, or roughness on the controls.

101. P. This man is stable, calm, and cool in normal circumstances.

N. Even in normal circumstances this man is nervous, flighty, excitable, and unstable. (DO NOT CODE emergencies, cf #7)

102. P. This man gets along well with his squadron mates.

N. This man does not get along well with his squadron mates. He may be described as irritable, unable to take kidding, moody, slovenly, complaining, and the like. He may be said to have a disagreeable or negative personality. (DO NOT CODE non-teamworker #1, rejection of suggestions #5, nervousness #101, projection of blame #9, laziness #12, inconsiderateness #20, unauthenticated claims #17, conceit #5, poor leadership #103, immaturity #24)

103. P. This man is a good leader and a good Naval Officer.

N. This man is not a good leader or is not a good Naval Officer. (CODE ONLY THE GENERAL STATEMENT. DO NOT CODE unfairness to subordinates #20, or consideration of personnel #20)

APPENDIX 2-4

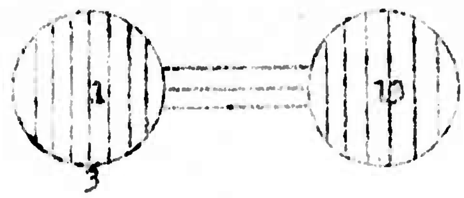
DIAGRAMMATIC REPRESENTATION OF CLUSTERS OF UNIT CATEGORIES, BASED ON SORTINGS BY 39 VETERAN PILOTS

Explanation of Diagram

A triple line between two categories indicates that at least 2/3 of the respondents placed the two cards in the same pile. A double line indicates agreement by at least 1/2 of the respondents; and a single line agreement by at least 1/3. A cluster was regarded as established only if (a) the unit categories involved were placed in the same pile by at least 2/3 of the respondents, or (b) the unit categories exhibited multiple interconnections. Connections which failed to meet these standards are indicated by uncircled numbers in the diagrams of Appendix 2-5.

APPENDIX 2-C

I Lacking in Teamwork



1. The lone wolf, apt to give very little effort to teamwork. He would fly off and leave you. Would do as he liked and let the operation go to hell.

13. He would save his own neck and let the rest of the outfit take care of themselves. Unduly worried about his own safety. Forgets he has a crew or a wingman.

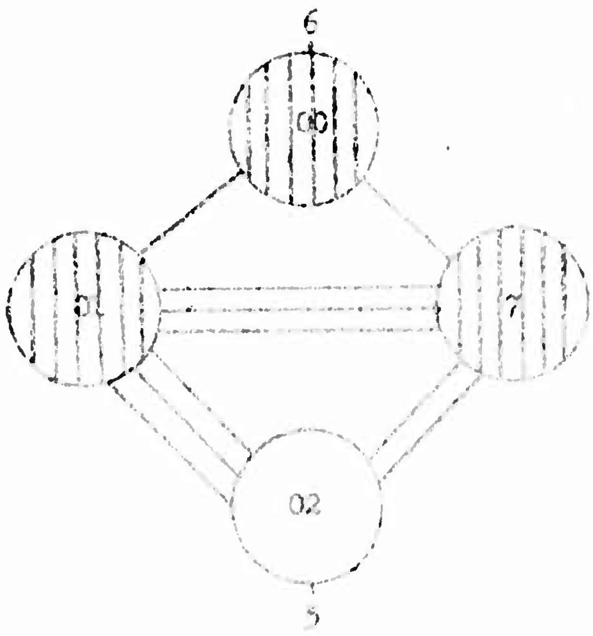
<u>NOTE</u>: The top nine categories in functional importance -- as rated by the respondent pilots -- are vertically cross-hatched on this and succeeding pages of Appendix 2-C.

II. Lacking in Motivation For Combat Aviation

4. Lacks confidence in himself or in his airplane. Has no desire to fight. Will find "reasons" to avoid hops and ways of evading combat.

21. Lacks desire to fly; would be willing to fly as little as possible. Dislikes acrobatics or close formation. Is afraid of the plane. May dislike his present classification.

III The Emotionally Inadequate



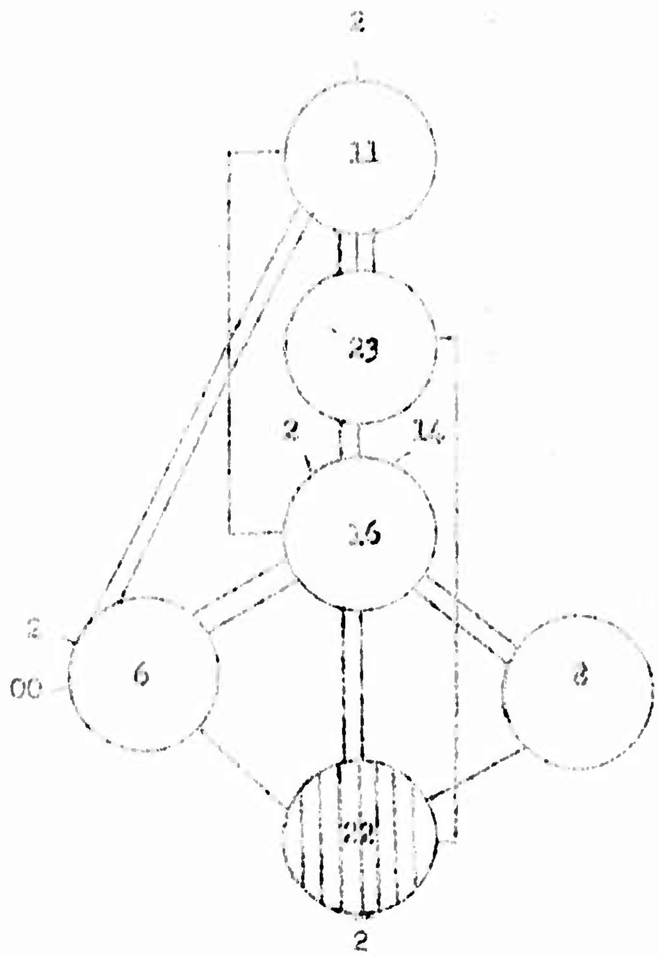
7. Fails under pressure. Becomes excited and loses his head in tight spots. Cannot be counted on in a pinch.

00. Erratic, unpredictable; you could never tell what he would do at any moment. Lags in formation and flies poor formation. Must be watched.

01. Nervous, tense, highstrung and easily excited in normal flying. Emotionally unstable; is shaken on slight provocation.

02. Temperamental, irritable, and quick tempered. Blows off handle too easily. Can't take kidding. Doesn't mix. Talks too much or whines when in trouble.

IV Intellectually Or Perceptually Inadequate



6. Doesn't use his head well in the air. Poor at grasping combat situations. Cannot adjust to varying situations.

8. No foresight in the air. Doesn't plan ahead but relies on luck. Either fails to reach a decision or jumps in without thinking.

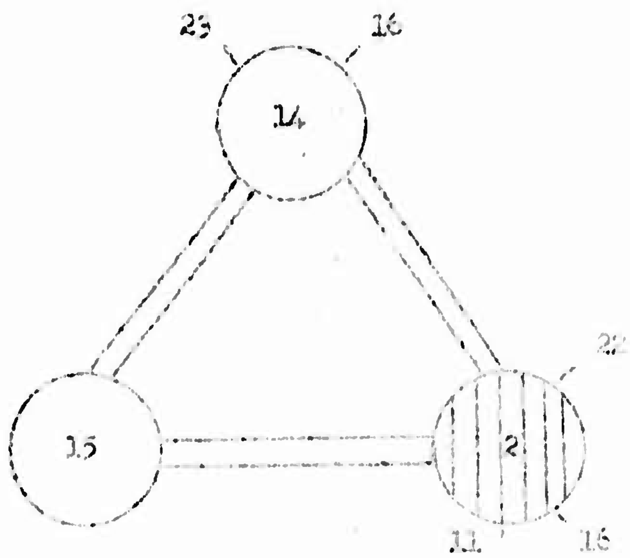
11. Slow to catch on; fails to get the word. Forgets or lacks the ability to learn.

16. Dopes off. Not aware of what goes on around him. Flies with his head in the cockpit.

22. Dilbert. He turns on his lights during pre-dawn raid "so he won't be run into." He is lost until he notices that the ocean is on the wrong side of him. He cuts one engine and feathers the other prop.

23. Slow in thinking and acting. Does not think fast enough to keep up with his airplane. Slow in arriving at decisions.

V Lacking Minimal Skills

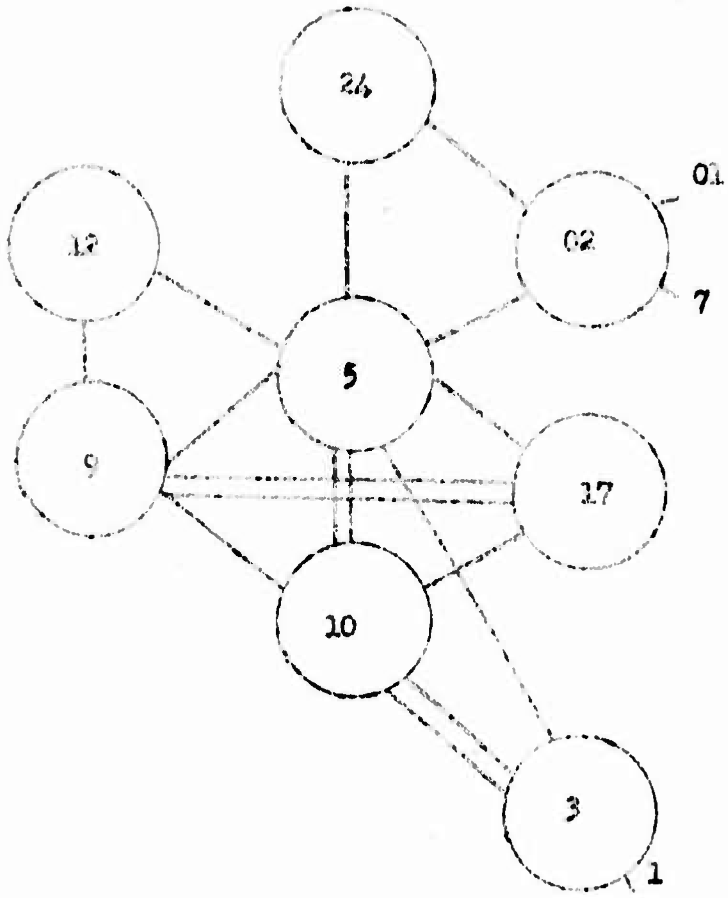


2. Can't handle plane or make it do what he want it to. Lacks flying skill. Poor in coordination.

14. Poor in navigation. Poor in instrument flying. Weak on aerology and aerodynamics. Doesn't know his plane.

15. Gunnery not expert. Makes excessive number of poor drops in bombing.

VI Immature



3. The Flat-hatter. Takes unnecessary risks which endanger the lives of other pilots. Does many foolish things in the airplane.

5. Cocky, conceited, hard-headed; stubborn. Won't listen to criticism. Resents being commanded to do something. Thinks his way is always right.

9. Free user of alibis and excuses.

10. Thinks he is a 'hot' pilot whereas he is exactly the opposite.

12. Irresponsible, lazy. Squeezes by instead of trying to better himself. Fails to carry through duties promptly and properly.

17. Claims hits where others saw misses. Cheats on his score. Exaggerates his experiences. Talks a good war.

24. Perpetual adolescent. The spoiled child; the mama's boy; the high school boy. The playboy who does not take his work seriously.

NOT CLUSTERED

28

28. Drinks too much.

(This card was put in a pile by itself by ½ of the respondents. It was not significantly paired with any other card.)

03

03. Lacks the ability to lead. Poor in handling discipline. Over-bearing to his juniors and a 'yes man' to his seniors. Men do not have confidence in him.

(This card was paired with each one of the other cards at least 3 times, but it was never paired with any one card by as many as 1/3 of the respondents.)

APPENDIX 3-A

STATEMENTS APPEARING ON "STIMULATOR CARDS,"
(PHASE I, LARGE SCALE FIELD INVESTIGATION)

APPENDIX 3-A

200. *B. He is erratic, unpredictable, and unreliable.

*A. You can depend on him to be where he should be and to do what he should do.

201. B. He is an individualist rather than a teamworker.

A. He is primarily a teamworker rather than an individualist.

202. B. He is nervous and excitable.

A. He is not nervous or excitable.

203. B. He avoids or evades air combat.

A. He has what it takes to face the enemy in air combat.

204. B. He just cannot fly well enough to be a combat pilot.

A. He is an above-average flier.

205. B. His air discipline is often poor.

A. He is definitely above average in regard to air discipline.

206. B. He is poor at sizing up situations in the air.

A. He is very good at sizing up the over-all situation in the air.

207. B. He just doesn't think clearly or plan ahead well.

A. He looks ahead, thinks things out, and makes sound plans for action.

208. B. He doesn't get along well with the other members of the squadron.

A. He gets along well with the other members of the squadron.

209. B. He dopes off or doesn't get the word.

A. He is alert and gets things right the first time.

210. B. He is not a good leader of men.

A. He is a good leader of men.

---

*B denotes "stimulator cards" used for Low nominees.

*A denotes "stimulator cards" used for High nominees.

211. B. He is poor at one or more of the following:

a. navigation
b. instrument flying
c. bombing
d. gunnery

A. His navigation, instrument flying, bombing and gunnery are very good.

212. B. He is likely to blow up when the going gets tough.

A. He is calm and steady in tight spots.

213. B. His combat-tactics are often poor.

A. His combat-tactics are usually sound.

APPENDIX 3-B

INSTRUCTIONS TO FIELD MEN, - (10-30-44)
AND INTERVIEWER'S CHECK LIST

APPENDIX 3-B

1 - 1: It is assumed that the following will already have been accomplished:

a. Squadron presentation of your orders and letters.

b. Your group discussion of validity and your project.

c. Arrangements for a room sufficiently isolated to give respondents a feeling of privacy.

d. A brief review with the respondent now before you of your mission as outlined to the squadron.

1 - 2: Now give him one "A" sheet and one "B" sheet. Show him how the sheets work, indicating that you will put nominee names in one envelope, respondent names in another, and descriptive statements in a third. Point out that, if any of the envelopes should fall into unauthorized hands, no one would be embarrassed, because the exhibit would be uninterpretable.

1 - 3: NOW SAY:

"Please fill in your name in full, last name first, on BOTH of these sheets, using the top box. Then give the entries called for on the second line." (Branch means USN, USNR, USMC, etc. Specialty means VF, VF, etc.)

****

2 - 1: Now point to the "A" sheet and say:

"Assume that you have orders detaching you at once from this Air Group and assigning you to another Air Group for combat. Your orders specify that -- regardless of your present rank or experience -- you are to fly wing on someone in this new Air Group." (In the case of P-boat men, substitute: "You are to fly as co-pilot.")

2 - 2: "Will you write down in space 1, here, (pointing) the name of any pilot, known to you personally, on whom you would be willing or pleased to fly wing. He may now be living or dead, he may hold a rank above or below you, and he may or may not be a member of your present air group. (For P-boat, substitute: "willing or pleased to fly as co-pilot.")

Please give the full name, if you know it. Now to help us use this in research, will you fill in the blanks on the second line.

a. Under 'Branch' specify USN, USNR, USMC.

b. Under 'Squadron,' give squadron number and year when he was in that squadron.

c. Under "Specialty," put down VF, VP, etc.

2 - 3: IF YOU WISH FREE RESPONSE FIRST, SAY:

"Now please write down under 'reason' your own statement of why you would like to have him on your wing. The more you can tell us, the more valuable your reply will be."

2 - 4: USE OF THE CARDS will either follow free response, or, if you wish, will come immediately after getting down your first high name. In either case, SAY:

"We have already tabulated the descriptions of 1000 'high' pilots who had been nominated by men who had been in combat areas. This gives us a sort of Gallup poll in which experienced men have stated in detail the sorts of men they'd like to fly wing on. (Serve as co-pilot for). It turns out that there are only about a dozen reasons for wanting -- or not wanting -- to fly wing on someone. (Or to serve as co-pilot for someone.) We've put these on cards, one to a card.

"Now what I'd like you to do is this. In order to get the best possible picture of the man you have just named (or described) I'd like to have you run through these cards. As you find cards that pretty well give your reasons for wanting this man, will you toss them over toward me. Hold on to the others."

2 - 5: Pick up the cards he gives you. THEN SAY:

"To help us to be sure that we know exactly what you mean, would you mind going through the cards you have picked and giving specific examples to show just how the cards apply. For example, you have picked '212.' Will you give a specific illustration of just how this man performed in a tight spot -- Yes, that's what we want; and I'll note down what you say on this sheet."

2 - 5a: Write down his remarks, as nearly verbatim as possible, identifying remarks by means of card-number. Begin on his original response sheet, if there is space left. When necessary, continue your entry on the "A" sheet bearing the next highest serial number. Note down on your first sheet the entry continued on A#319, etc.

2 - 6: When he has finished describing the categories on the cards, SAY: "Would you mind turning the other cards over, to see if any of the statements of less desirable characteristics apply to this man?"

2 - 6a: If he chooses any "low" cards, ask him to specify as above.

2 - 7: When he is through with the cards, ASK HIM: "Is there anything else you would like to tell me about this man?"

2 - 7a: Note it down in your continuing account, if there is.

****

2 - 8: This completes a run for one high name. To get your second high name, repeat as much of the above as may be necessary. Abbreviate as the occasion permits.

****

3 - 1: Introduce the request for low nominations.

"That gives us the two names for the high list. Now for the lows. Please keep in mind that this is quite impersonal. It's just as if we were asking you to use your experience to help the Bureau decide between two makes of aircraft engines. When you tell us about men you don't want on your wing, (or as your co-pilot) you're not down-rating a man on his fitness report. You are simply allowing us to make holes in a punch card so that we can tell the Bureau what sorts of men NOT to forward through training."

3 - 1a: Go ahead as follows:

"Assume again that you are ordered to a new Air Group. This time your orders state that you are to pick two men to fly on your wing. Under such orders, will you name two men whom you definitely do NOT want on your wing. Again, these men may be living or dead, they may hold any rank, and they may or may not be members of your present Air Group." (For P-boats -- you are to fly as P.C. Name two men not wanted as co-pilot.)

3 - 2: Point to the "B" sheet and say:

"Please put your first man's name down in this box and your second man's name in this box on the other side. Then fill in as accurate an identification for each man as you can, using the second line for this."

3 - 2a: Then TEAR OFF THE TOP SLIPS, calling the respondent's attention to the fact that you are doing so. Put them into an envelope while he watches and secure the envelope in your safe, briefcase, or locked drawer.

3 - 3: IF YOU ARE USING FREE RESPONSE FIRST, ask the respondent to give his reasons as you did with the highs.

3 - 4: USE OF THE CARDS follows:

"On this side of the cards is what experienced pilots have had to say about men they don't want on their wings. (Or as co-pilots.) Will you sort the cards as before, letting me have all of the cards that pretty well state your reasons for not wanting your first man on your wing. (As co-pilot)"

3 - 5: Then hand back the cards that have been selected and ask the respondent, as before, to give specific examples.

3 - 6: Now reverse the unselected cards and ask if any of them apply. If any are selected, get statements of examples.

3 - 6a: In completing the above, use sheets bearing the next higher serial numbers, noting continuation on the original sheet.

****

3 - 7: Now ask if there is anything else the respondent can tell you about the nominee. If there is, note it down.

3 - 8: Then go ahead with your #2 low man, abbreviating the instructions as much as the situation will permit.

****

If questions should come up regarding the reason for needing illustrative material, use specific instances in explaining to the respondent how categories of lowness may be predicted or used in early training to eliminate less desirable men when a surplus is present. Show him what this means in terms of his own squadron.

****

4 - 1: BEFORE THE RESPONDENT LEAVES, put all materials into CONFIDENTIAL envelopes and put these into secure places. Answer any residual questions he has. Be sure to thank him for participating. Ordinarily you will ask him to send you the next respondent.

MAILING:

1. Use CONFIDENTIAL air mail only.

2. Send nominee names in one envelope, respondent names in a second, and descriptive material in a third for the Lows.

3. Unless you run into specific objections, all High materials can be forwarded in one envelope.

4. Note that CONFIDENTIAL MAIL requires the use of two envelopes. Only the inner one is marked as CONFIDENTIAL.

CHECK LIST USED BY INTERVIEWER TO INSURE COVERING
ALL POINTS IN INTERVIEW

INTRODUCTION

1 - 1: Review security provisions

1 - 2: Give R one "A" and one "B" sheet

1 - 3: Have him fill out his name and identification on BOTH sheets

HIGH NOMINATIONS: ("A" Sheet)

2 - 1: Instructions

2 - 2: R fills in ONE high name and identification

2 - 3: (If using free response, R supplies description for this high. HE writes.)

2 - 4: Explanation of cards: hand them to R

2 - 5: Have R give examples for each card: you note them down

2 - 6: Reverse balance of cards. Have R sort these and explain any he accepts.

2 - 7: Ask for other descriptive material

2 - 8: REPEAT FOR SECOND HIGH NAME

LOW NOMINATIONS: ("B" Sheet)

3 - 1a: Introduction and basic instruction

3 - 2: R fills in BOTH low names and gives identification

3 - 2a: Tear off and secure name slips

3 - 3: (If using free response, R describes both lows. HE writes.)

3 - 4: Give low cards to R. He makes his choice. (First name)

3 - 5: Get examples of selected cards. You write.

3 - 6: Reverse balance of cards. R sorts and explains any accepted.

3 - 7: Ask for other descriptive material

3 - 8: REPEAT #4 to #7 FOR SECOND NAME

CLOSE THE INTERVIEW:

4 - 1: Demonstrate security provisions

4 - 2: Thank respondent

APPENDIX 3-C

EXCERPTS FROM INFORMAL REPORTS OF FIELD INVESTIGATORS
MADE DURING PHASE I OF THE MAJOR STUDY

APPENDIX 3-C

A. Excerpts pertaining to the reception accorded the project and the field investigators. The investigators found, with few exceptions, willingness on the part of the pilots and their commanding officers to cooperate with the project, as indicated in the following excerpts of correspondence from the field investigators.

I haven't been over with any of the interviewing gear yet, but have talked to the squadron skipper and others and they have expressed interest in what we are trying to do. If they don't leave before I can get over there again I will try to get some interviews with them.
21 Dec 1944 -- Macmillan

Through him (a former acquaintance) it was possible to gain almost immediate entre to the pilot's ready rooms and spend some time shooting the breeze and generally getting acquainted. Of course I had previously met the SMO and the other flight Surgeons and in due time had advised them of my mission. The acceptance was definitely favorable and the cooperation has been excellent.
30 Dec 1944 -- Lyon

Cooperation both from the Wing, squadron leaders, and the pilots themselves leave nothing to be desired. The interviewing has gone slowly as it was anticipated it would. The mere routine of explaining the mission, to each pilot, securing nominees, using cards, etc. takes usually from one hour to one hour and a half. The shortest interview I have had has been two hours; the longest five. The median length is 25 Dec 1944 -- McGehee

I met the members of the air group a couple of days after I reported aboard, but not in my official capacity. I went to the Air Group Commander and told him of my mission and explained it to him as well as I could. He seemed a little put out about it and asked me to wait till after the forthcoming strikes were over before beginning to interview the pilots. Of course I agreed since he wished it, but was disappointed at not being able to get right to work.
9 Feb 1945 -- Macmillan

B. Comments on the methods prescribed for collecting data. The chief difficulty experienced was that the individual interviews took too much time. The following excerpts from correspondence are illustrative of this point.

Many sessions have run to three hours. If the free response was also introduced, this time would be extended and I feel that cards would

duplicate much that had already been covered.
30 Dec 1944 -- Lyon

I have seen Verne Lyon several times. He has had a private cabin on his ship and has interviewed many more pilots than I have. He agrees with me, however, in the length of time it takes to interview one man. Two hours is about the least that can be allowed.
9 Feb 1945 -- Macmillan

Verne has mentioned the time consumed in getting specific data from respondents about their high nominations. Though I didn't turn in nearly as many interviews as any of the others I found it very tiring to spend an hour to an hour and a half on the Highs alone. I think the pilots found it so, too. We all agree that after interviewing three men in one day we were pretty well bushed. The low nominations are much easier to get because of the specificity of reasons for nominations and the fewer cards chosen for each nominee.
24 Mar 1945 -- Macmillan

C. Opinions on the value of the "Stimulator" cards.

In general I like the card system very well -- find that it is useful and that the pilots consider them helpful in formulating their ideas. There is, however, one consistent complaint that keeps cropping up -- the cards overlap. The reason offered in explaining one card will often encompass several other cards and the pilot will frequently say "Well, I've already covered that." They themselves comment repeatedly on the duplicity of ideas. I believe that in most cases there are only a few dominant reasons for wanting a particular pilot and that additional cards are selected because they support these basic reasons or represent other general aspects of goodness or badness. We ask the pilot to indicate the one, two or even three cards, of those selected, that he regards as most important for the individual who has been nominated.
23 Mar 1945 -- Verne Lyon

1. "These cards seem to cover everything that could be said about any pilot. I can't think of anything further to add."

2. "Some cards seem to duplicate or overlap each other." For example, 202A and 212A. (The 'A' refers to the desirable trait or characteristic.) 200A and 201A. 206A and 207A. The pilots will say, "Well this has already been covered by another card".....and will then refer to one of the examples cited.

3. I have found that many of the pilots accept the cards on their face value and are unable to give specific instances or elaborate on their reasons for selecting a particular card. They will say, "Well, that's it." "That describes him." "I can't give you any example, but I just know that is the way he would be -- or that is what he would do." This general attitude is more peculiar for the High's than it is for the Low's. You will note that on many of the forms I have sent back to the section, only a card number will be recorded. No amount of encouragement on the part of the interviewer has produced specific material. For the respondent the card tells the story.

4. Many more cards are selected to describe High men than are used to depict Low men. The general feeling seems to be that your High man has practically ALL of the favorable attributes. Otherwise he would not be regarded as a High. This is not true of the Lows -- a man may have only a few undesirable characteristics to stamp him as unwanted. The pilots can also be more specific in discussing the Low cards.

5. Perhaps there should be some modification of instructions in presenting the cards to be used in describing the High nominations. It might be said, "Select ONLY those cards which represent definitely stand-out characteristics for this individual." I believe that in many cases where all the cards are selected to describe a High, it is because the respondent cannot conscientiously reject any of them -- all are true, to a degree -- but not the same degree. This impression is substantial when the respondent is asked to be specific.

6. In reversing those cards not selected for the Highs and Lows, there is a much greater tendency to identify good characteristics for the Lows than to select the less desirable traits for the Highs. This, of course, is what you would expect.

7. I am impressed by the frequency with which the element of "personal feeling" enters into the selections of High men. Time and again I have noted these comments, "I would like to fly on his wing because I know him so well personally." "He is my best friend and I know just what he would do." Or, "He is my best friend -- I would not leave him and I know he would not leave me." One pilot said he would rather fly wing on a personal friend who was a poor flyer than to fly wing on someone he didn't know, who was a good flyer. I believe that we are getting a halo effect with the cards for the High nominations and that some thought should be given to a modification as indicated in No. 5. I have tried this approach on several cases and found it to have a desired effect.
30 Dec 1944 -- Lyon

Practically two-thirds of the interview is consumed in extracting the attributes of a wanted pilot -- and most of the reasons are stereotyped -- whereas only about a third of the time is required for the unwanted. Of course there are several reasons for this -- (1) More cards are selected for the Highs, and many of the reasons for selecting these cards have to be developed. (2) The reasons why a pilot is not wanted are generally much more clear cut and specific -- and fewer in number.
23 Mar 1945 -- Lyon

The cards have been used both after a free response and as the first step after securing the nomination. It seems the cards work much better if used before the free response as there is a tendency to feel that the respondent thinks he's given you the word and is a bit surprised when you spring the cards on him. I have however found the cards particularly useful with the less verbal type of pilot.
25 Dec 1944 -- McGehee

In our effort to make them mutually exclusive and unequivocal they became emasculated and we ended up with the "epithets" which we distrusted so. I can't imagine a pilot looking at any one of the cards, slapping his knees and saying, "That's Joe to a T." Some of the categories are better stated in Technical Memorandum No. 4 (which I'm glad to have, by the way) and the latter includes dimensions not on the cards.
9 Jan 1945 -- Bennett

Now for a word about procedure. My results here are based upon "free response" plus an unsterectyped interview. I tried the cards a few times and then discarded them. The men will take 20 minutes to an hour for their written statements. Introduction of the cards and discussing them can easily take another half to three quarters of an hour. After having his comments steered, kept to the point, for that long, the pilot is usually anxious to get away. I tried discussing the cards after each free response -- which tends to make the written statements briefer. I tried having them write and then chatting a while before presenting the cards -- but it was cold turkey then. I think a careful discussion of the cards plus written response is too much to try to get in the one session contact.
9 Jan 1945 -- Bennett

D. Suggestions toward the use of a check list.

Now for a word about procedure. Even before your letter authorized it, I had decided to "stuff" the cards. Yet I wanted something besides the free response. So I went back to Technical Memorandum #4, and even to my Washington notes, and reexamined the cards as well -- and set up my own phrasing of reasons -- 18 for A's and 20 for B's. To avoid confusion (or maybe it adds to it) I assigned letters to my categories.
11 Mar 1945 -- Bennett

The more I study the list of characteristics in the Aviation Psychology Bulletin the more convinced I am that a usable check list for administration to relatively large groups of pilots could be made from it. If administration of such a check list to large numbers could be combined with an intensive study of a dozen or so squadrons, I believe data for combat criteria could be gathered in half the time which will now be required. An entire squadron could be covered in two or three hours with a check list. A six week period with big boat squadrons and a month with VF or VT squadrons would be sufficient to make an intensive study. I, as I have said before, believe it would be very beneficial if you could come to Pearl Harbor and meet with us around March 1, at which time we all will be returning.
7 Feb 1945 -- McGehee

The list of traits as worked out in the Aviation Psychology Technical Memorandum "The Combat Criterion ---" seems to me to have definite possibilities as a check list after free responses have been given. I would like to use it as a mimeographed form for the pilot to check, without further explanation from him, on each of his nominees. Further I think it could be used for collecting group data in the states. With VTB squadrons out here there is no place to assemble the men for group work.
25 Jan 1945 -- McGehee

Let us hear from you regarding the modified procedure suggested in Verne's letter. It seemed to both of us who had been on carriers before that detailed information about the high nominations would not yield as much worthwhile material as those on the lows, and time saved by cutting down on the specificity would be better used in getting background information about the pilots. I favor putting down all the reasons given in Tech Mem 4 and letting the pilots use them as a check list, emphasizing that we want him to check only those that are outstanding in his nominees. This would get all the necessary information and cut down the halo effect that we found so prevalent in discussion of "highs" on our last trip. As yet the four of us have not agreed completely on procedures, but I hope we can work something out before we go to our respective ships.
24 Mar 1945 -- Macmillan

E. The applicability of the procedures to patrol pilots.

Incidentally, some of the cards in their phraseology impress the respondents as being more applicable to carrier based groups. For example, a P. P. C. rarely does any navigation and his gunnery consists in placing the aircraft in a position to give his gunners the best advantage.
25 Dec 1944 -- McGehee

Several suggestions have been made for rephrasing the instructions to avoid the subordinate role implied in being a co-pilot. The most frequent is to phrase the directions in terms of "If you were a squadron CO what two naval aviators would you want (or not want) in your Squadron."
25 Dec 1944 -- McGehee

From talking with both the plane commanders (P.P.C.s) and co-pilots, it is my opinion that the relationship between the P.P.C.s and the co-pilots is in a different order from the relationship between a wing leader and his wingman in VF, VTB, or VB operations. The co-pilot is essentially an apprentice; he handles the plane only when the P.P.C. directs. (Good P.P.C.s give their co-pilots definite opportunity along this line). The Wingman in VF operations, while dependent on his section leader, is nevertheless responsible for his aircraft. He is more independent than the co-pilot. I have not worked with VF groups so this may not be an accurate statement of the matter; but the subordination of the co-pilot to the P.P.C. is very obvious in multi-engine aircraft in combat operations.
25 Dec 1944 -- McGehee

7. The material contained in this report tends to confirm data submitted in my first report of 25 December 1944.

2. The use of cards in interviews seems of doubtful value.
   a. The phraseology is not entirely appropriate to patrol pilots.
      (1) "Individualistic" has definite good as well as poor connotations to pilots.
      (2) Air discipline means many things to many men.
      (3) Navigation is not a function of a PPC.
      (4) Men do not fly formation on combat patrol so many of the items rest on hearsay.
   b. Pilots feel they have given you the word when they make a free word response and seem a bit resigned when the cards are lugged out.
   c. It is felt that the cards for a certain answer, i.e., to justify his choice a pilot picks cards which may be characteristic of an ideal pilot.
   d. It is urged therefore that cards as a necessary part of the interview be dropped and that optional use be substituted. The real value of the cards are found with the occasional non-verbal pilot.
3. Pilots continue to insist that, for patrol bomber squadrons, the basic questions should be phrased in terms of whom you would and would not want to have in a squadron.

1 Jan 1945 -- McGehee

F. <u>Transportation and other difficulties in getting to the squadrons.</u>

Boat transportation while in port is a real problem in trying to get to some specific destination, and I am afraid that a person on shore in attempting to travel to and fro each day would spend half of time waiting. Too, the times that we have been in port have been so short that only a very few pilots could have been reached.

30 Dec 1944 -- Lyon

I would like to bring up something that Verne and I have discussed and agreed upon and about which he has written to Capt. Groesbeck if not to the Section. That is the difficulty we would run into if we were stationed ashore while working with carrier pilots. Where we are now is the most advanced large fleet base. There is a squadron of PBM's here and a Marine night fighter group, but no other shore based pilots. In fact the Marines are the only shore based ones as the PBM group is based on a tender. If we were stationed ashore it would be practically impossible to contact many pilots from carriers, not so much because the fleet is not here often and not for long when it is, but because when it is here there are no available boats. From experience I would say that if I wanted to get to a specific carrier I would have to spend a couple of hours trying to get a boat, then if I did get one it might not be able to bring me back again and I would be stranded on the carrier. I feel, and Verne with me, that as long as we want interviews with carrier based pilots the best and only way to get them is to live on the carrier with them for a period of weeks or months or until most of them have been interviewed. Even ashore with conditions perfect I don't believe we could get more than three or four interviews per day, and we would never get that many if we had to spend several hours getting to and from the carriers. Verne gets about three

men a day when the going is good and I could do the same and hope to on this operation now that we have a decent commander and I have a relatively private room.
9 Feb 1945 -- Macmillan.

If Fleet Air Wings in other fleets operate as do those in the 7th Fleet, I believe from my experience that it is not the best situation for our work to be ordered to a wing. Squadrons are shifted back and forth and it is very difficult to always be with some squadron as a wing may be stationed many miles away. I understand the wing has little authority over assignment of personnel, etc. to these squadrons. It would seem to me that assignments in the future should be made in the following manner:

(1) To specific ship or ships, i.e., CVs or CVPs or sea plane tenders.
(2) or to a specific number of squadrons (with luck you can cover your work in a big boat squadron in two weeks).
(3) or to Commander Air Force X Fleet, who then could send you from squadron to squadron.

I shall be most interested in finding out how Chet made out with his assignment to an Island Commander. I am wondering if he had difficulty in contacting squadrons, as from what I have seen of island commanders they have little or no direct control over aviation units. In fact I am inclined to think Verne's and Jack's set up is the best for securing the most comprehensive data in the shortest possible time.
7 Feb 1945 -- McGehee.

The ideal set-up would be for each of the men working with carrier pilots to have orders enabling him to go to one carrier, stay there until the interviews were completed and then to another one, and so on.
9 Feb 1945 -- Macmillan.

G. Comments on leadership in combat aviation.

The suggestion comes frequently from the more mature pilots that in selection we look for the amount of responsibility a cadet has taken on in civil life before enlisting. Inability to respond to the demands of life out here is frequently traced to irresponsibility in civilian life.
1 Jan 1945 -- McGehee

In the first place the contrast between leadership was terrific. YY (an air group) had as ACG one of the most egotistic, vindictive, inconsiderate men I have ever known. He had no feelings for his pilots and I have heard him tell the group that he didn't give a damn if they didn't get back from strikes, as it was no skin off his tail. He was obviously out there for his own glory and let anyone know it who asked; I think the interview blanks I sent in pretty well cover most of his faults. AG-XX had a very capable man in charge whom I got to know quite well during his first week on the ship. He was very helpful and interested in what I was trying to do. His exec was also extremely nice. The skipper was lost on the first Tokyo attack and the exec took over with no apparent loss of morale in the group. The most morale boosting event that could have happened to AG-YY would have been the loss of their skipper, but he always managed to get himself back,

even though the pilots said he was directly responsible for the death of three fighter pilots in so doing.
24 Mar 1945 -- Macmillan

I find two schools of thought on what part the CO of a squadron plays in the success or failure of a squadron. One school believes "as the CO is, so is the squadron." The other school says the CO, Exec and other officials may be duds but if there is a key man or men who have no official job other than to fly who carry the squadron, the squadron will perform splendidly. It reminded me of the "unofficial boss" idea contained in studies at Western Electric.
17 Dec 1944 -- McGehee

H. Miscellaneous

Chet and I have talked over our experiences with VPB squadrons. In the main our experiences are similar. We both found emphasis on "caution" as a characteristic of high run. I agreed with him fully in the balief that the data we have should be used in the problem of assignment to specialized squadrons as well as to the problem of initial selection. We both found that the cards stink. I'm glad mine got shot up; just wich they'd been shot up sooner or I had had enough initiative to junk them.
10 Mar 1945 -- McGehee

The experience so far has confirmed my feeling that following one squadron through to completion is preferable to an equal number of interviews sampling several groups. This may not always be possible and I'll be interested in trading views with the others on this point, but I think I'll make every effort myself to follow through on one squadron at a time. The multi-engine PPC's do not "fly with" each other much, and the senior men are especially prone to go outside the squadron for their nominees. I think the co-pilot opinions are needed to fill out the picture. The more duplication we get of the pilots' circles of acquaintance, the more likely we are to get the repeat nominations.
11 Mar 1945 -- Bernett

Incidentally, the men interviewed are not too vitally concerned with our security provisions. They seem to take my word for it and dismiss it.
25 Dec 1944 -- McGehee

APPENDIX 3-D

FORMAL REPORTS SUBMITTED BY FIELD INVESTIGATORS
AT COMPLETION OF INDOCTRINATIONAL TOUR OF DUTY
(PHASE I, LARGE SCALE FIELD INVESTIGATION)

NOTE ON OMISSION OF
PAGES 329 - 342 INCLUSIVE

Pages 329 to 342 inclusive, representing the formal reports of the four Field Investigators on their activities during "Phase I" of the large scale data collection program, are omitted from this copy of the report, since these materials have not been declassified.

APPENDIX 3-E

INSTRUCTIONS AND MATERIALS, POA FIELD INVESTIGATION
(PHASE II)

a. Basic Instructions for Field Investigators.

b. Checklist A and B Procedures.

c. Nomination Form Procedures

d. Outline of Basic Tasks for POA Investigators.

APPENDIX 3-B, a

BASIC INSTRUCTIONS FOR FIELD INVESTIGATORS

1. Background discussion of project and results

2. Distribute R sheets

3. Have Rs fill in their names and identification

4. Have them tear off their names and pass to you. Put these in an envelope and SAY:

   More than 1000 pilots have already given us their responses in this project. They have given responses which have been very frank -- and therefore valuable. The main reason why we have been able to obtain such frank responses is that it has been possible to guarantee absolute security to all answers received.

   One phase of this security lies in the transmission back to the Bureau of what you have to say. Your names will be mailed out in this envelope. Your answers, identified by serial number only, will be sent by confidential mail in another envelope. If either one gets adrift, no harm is done, since the one envelope contains only a roster and the other only some names and a bunch of numbers.

5. Now distribute the A lists

6. SAY:

   Assume that you have orders detaching you at once from this Air Group and assigning you to another Air Group for a tour of combat duty. Your orders specify that -- regardless of your rank or experience -- you are to fly wing on someone in the new Air Group.

   Write down on line #1 here (pointing) the name of any pilot, known to you personally, on whom you would be willing or pleased to fly wing in such an assignment. He may now be living or dead, may hold a rank above you or below you, and he may or may not be a member of your present Air Group. The important thing is that he should be known to you personally and that you would be willing or pleased to fly on him in combat.

6. SAY:

   Assume that you have been incapacitated while on a combat mission and that you must turn the control of your plane completely over to your co-pilot. In this situation, of all the men you know in Naval aviation, what man would you be best satisfied to have take over the controls to complete the mission and bring you back to your base?

Write the name here on this line. The man you choose may be of any rank and in any squadron. He may now be living or dead. The important thing is that he should be known to you personally and that you would be satisfied to have him take over completely the control of the plane in which you are riding.

7. SAY:

Now fill in as much identification as you can possibly give. Use the spaces as labelled. If you can name the squadron, by all means do so. If you cannot, then give the place and month and year when you were last associated with him.

8. SAY:

The sheet labelled "A List" contains the 22 most common reasons for selecting a man to fly on (to take over.) These are based on responses already given by more than 1000 combat-experienced pilots.

Consider carefully the man whose name you have just written down. Then go down the A List and pick out the reasons that apply quite specifically to this man. Then, on your answer sheet, circle the numbers of all the reasons that apply. If you have any doubt as to a particular reason, don't circle it. You may end up with 20 numbers circled or with 2; you probably won't want to use all 22.

Are there any questions?

9. SAY:

Now let's go back over the list a second time. This time will you pick out not more than 3 of those reasons in which your man is truly outstanding. Indicate these by putting a cross in the circle over the corresponding number. Like this. (Show how, either on a large sheet of paper or on the blackboard.)

10. SAY:

Now move down to the second space provided for a name, here (Pointing.) Here we want you to follow through the procedure a second time, again picking a pilot of your acquaintance on whom you would be willing or pleased to fly wing in combat (to whom you would be willing or pleased to turn over the controls).

Again give us the best dope you can on his full name, rank and squadron. Then go over your A list again and pick out the reasons that apply to this man. Finally, select not more than 3 reasons in which he is outstanding and put a cross inside the corresponding circle.

11. Collect the A Lists.

12. Distribute the B Lists.

13. SAY:

You turn your answer sheet over. The answers you have just given will help the Bureau research unit to build up their file of men WANTED by their squadron mates. To get at the opposite end -- the NOT WANTED end we'd like to have you work under the following instructions.

VC Again assume that you are transferred to a new squadron. This time your orders designate you as a Section Leader. You are authorized to pick your own wingman from all men known to you in naval aviation. In this situation, write on Line 1 (here) the name of one man whom you very definitely do NOT want on your wing in combat.

VP Again assume that you are transferred to a new squadron. You are authorized to pick your co-pilot from among all the men you have known in naval aviation. Write on Line 1 the name of one man, known to you personally, whom you do NOT want as your co-pilot on a combat mission.

14. Now indicate the reasons for your selection by circling the numbers of all reasons which apply to this man. Indicate not more than 3 of these as outstanding by putting crosses within the appropriate circles.

15. SAY:

Now will you indicate your second choice on Line 2, using the same basis as for your first choice. Again mark all numbers of reasons that apply. Indicate not more than 3 outstanding reasons by putting crosses within the appropriate circles.

16. Collect all papers. Mail by CONFIDENTIAL mail to BuMed, placing names of nominators in one envelope, the balance of the R sheets in another.

NOTE: The opportunity for free comment should be played up. Each time a nomination has been made and the check-list worked over, some such invitation as the following should be used:

It will add a good deal to the value of your response if you will use the space below the numbers for any comment you may wish to make in regard to the men you have named. If a man has repeatedly led cripples back to the ship, a note to that effect points up our research. If a pilot has given a lot of time to training his new men, we'd like to know about it. The more specific your comment is, the more valuable it will be.

Entries like "a good Joe," "a real pilot" tell us very little. The most useful comments take some such form as "Navigation excellent; flew 140 miles under terrible conditions and hit the base right on the nose," or "Under attack by 7 Zekes, brought his team home and personally accounted for 2 of the attackers."

APPENDIX 3-E, b

CHECKLIST A PROCEDURES

Listed below are the reasons most commonly given by combat-experienced pilots for selecting men with whom they DID want to fly on future combat missions.

1. He feels responsible for the safety of all personnel flying in combat with him.

2. Takes his job seriously.

3. Even-tempered and well-balanced on the ground.

4. Steady and reliable in the air.

5. Alert. Knows what's going on every minute in the air.

6. Gets the word quickly and remembers well.

7. Is aggressive. Presses home the attack.

8. Thinks fast enough to reach wise decisions quickly.

9. A team-worker. You can count on him and he will count on you.

10. Welcomes suggestions and reacts well to criticisms.

11. Gets along well with squadron mates; mixes well.

12. Accurately sizes up tactical situations.

13. Easy-going and not easily excited.

14. Does not take foolish risks which endanger the lives of others.

15. Knows his airplane and its equipment.

16. Always thinks ahead and figures things out. Has a plan for any situation that is likely to come up.

17. He is a real leader of men. Has the respect and confidence of others.

18. Holds up well in tight spots.

19. Loves to fly.

20. Excellent in one or more of the following: (Specify by letter.) (a) Bombing; (b) Gunnery; (c) Instrument flying; (d) Aerology; (e) Navigation.

21. Carries out his responsibilities promptly and properly.

22. Excellent plane-handler. Gets the most out of his airplane.

APPENDIX 3-E, b

CHECKLIST B PROCEDURES

Listed below are the reasons most commonly given by combat-experienced pilots for selecting men with whom they did NOT want to fly on future combat missions.

1. Too worried about his own safety. Would save his own neck even at the expense of his squadron mates.

2. Hasn't grown up. Doesn't take his work seriously

3. Temperamental, irritable, or quick tempered on the ground.

4. Erratic, unpredictable in the air. You can never tell what he will do next.

5. Goofs off. Flies with his head "in the cockpit."

6. Just doesn't get the word. Learns slowly and forgets fast.

7. Avoids or evades going on combat missions.

8. Can't make up his mind quickly. Doesn't think fast enough to keep up with his airplane.

9. No sense of teamwork. Would leave you in the lurch in order to make a name for himself.

10. Won't listen to criticism. Thinks his way is always right.

11. Keeps to himself; doesn't mix.

12. Poor at sizing up tactical situations.

13. Nervous and tense even on the ground.

14. Deliberately takes foolish risks in his airplane, unnecessarily endangering the lives of others.

15. Doesn't know his airplane or equipment.

16. Doesn't plan ahead but relies on luck. Acts first and thinks second.

17. Not a leader of men. Doesn't have the confidence and respect of others.

18. Likely to blow up when the going gets tough

19. Lacks desire to fly.

20. Poor in one or more of the following: (Specify by letter.) (a) Bombing; (b) Gunnery; (c) Instrument flying; (d) Aerology; (e) Navigation.

21. Irresponsible, lazy, or careless. Doesn't carry through his duties promptly and properly.

22. Just can't fly well enough.

23. Always has excuses for anything done wrong.

24. Dilbert. Always pulling some dumb stunt.

25. Thinks he is a hot pilot.

26. Lies about his experiences and cheats on his score.

APPENDIX 3-E, c

NOMINATION FORM COMPLETED BY RESPONDENTS
(Phase II Procedures)

Today's Date______________

Your name____File #__________________
(Last) (First) (Middle)

Rank________________________USNR Squadron______________________________

- -

#1 Name____RANK______________SQUADRON_________
(Last) (First) (Middle)

The reasons I have circled below apply to this man:

1 2 3 4 5 6 7 8 9 10 11

12 13 14 15 16 17 18 19 20 21 22
a b c d e

Other comments on this man: (Write below.)

- -

#2 Name____RANK______________SQUADRON_________
(Last) (First) (Middle)

The reasons I have circled below apply to this man:

1 2 3 4 5 6 7 8 9 10 11

12 13 14 15 16 17 18 19 20 21 22
a b c d e

Other comments on this man: (Write below.)

- -

#1 Name________________________________RANK______________SQUADRON________
(Last) (First) (Middle)
The reasons I have circled below apply to this man:

1 2 3 4 5 6 7 8 9 10 11 12 13

14 15 16 17 18 19 20 21 22 23 24 25 26
a b c d e

Other comments on this man: (Write below.)

- -

#2 Name________________________________RANK______________SQUADRON________
(Last) (First) (Middle)
The reasons I have circled below apply to this man:

1 2 3 4 5 6 7 8 9 10 11 12 13

14 15 16 17 18 19 20 21 22 23 24 25 26
a b c d e

Other comments on this man: (Write below.)

APPENDIX 3-E, d

OUTLINE OF BASIC TASKS FOR POA INVESTIGATORS

1. Maximize the N, using the group techniques with all but home squadron.

2. Discontinue use of stimulators. Use free response, employing standard sheets.

3. With home squadrons, use free response in individual interviews.

4. When the situation permits, use check list supplied to make rapid study at least two weeks after completion of free response survey.

5. Three special studies should be carried out for a total of at least two Air Groups per investigator:

   A. Using technique previously tried out with Air Group 16, obtain sorts on the relative importance of the revised DCNO categories.

   B. Using technique agreed upon, obtain sorts as to the estimated frequency of occurrence of categories under instructions aimed to establish the relative frequency that is believed to obtain among the categories rather than the pilot population at large.

   C. Using technique agreed upon, obtain sorts to indicate the amount of trouble respondents have had with each of the categories <u>in the combat area</u>.

APPENDIX 3-F

TECHNIQUES OF PREPARING AND ASSEMBLING RAW DATA (PROCEDURES FOR DATA FROM PHASE II)

APPENDIX 3-F

The data sheets, see Appendix 3-E, were transmitted to AIB in Washington either by confidential mail or by personal delivery (upon the return of the investigators from the Pacific Ocean Area). The respondents' identification slips were torn off the nomination sheets and transmitted separately in order to provide some degree of security for the basic information in case the data should go astray. The investigators transmitted the data in such a way that it would be possible for AIB to match the respondents and the nomination sheets. This was usually done by assigning matching numbers to the sheets. (When data were personally delivered, it was usually found that the respondent slips had not been separated from the forms.)

Upon arrival at AIB, the materials were treated as follows:

1. Respondent slips and nomination sheets were assigned matching numbers; these numbers are hereafter called "respondent numbers." The respondent numbers were printed on the data sheets by means of a numbering stamp.

2. Respondent slips were filed alphabetically in order to facilitate searching for identification information on nominees who might also be respondents. (No duplicates were found in as much as field investigators had been given instructions not to obtain nominations from individuals who may have served as respondents previously in this same phase of the study -- i.e., under the "check-list nomination" system. Some few respondents may however have served as informants in previous phases of the investigation, although this detail has never been checked.)

3. Steps were taken to identify more completely the nominees listed on the nomination sheets. It was to be expected that respondents would not be able to identify their nominees very accurately. Names were quite frequently misspelled, and the listing of each nominee's rank and squadron could sometimes only be regarded as a lead to the proper identification of the individual when used in conjunction with such sources of information as squadron rosters, the Navy Register and the Naval Reserve Register, and BuPer personnel records. Some of the field investigators had already been able to furnish more complete identifying information for nominees present in the specific squadrons studied. The work of identifying the cases was time-consuming but in most cases led to identifications which would probably stand up in a court of law. In other cases it proved impossible to identify the nominee satisfactorily on the basis of the information available. Such cases, of which there were approximately 500, were discarded. Nevertheless, there was very little evidence that respondents were giving faked names. The major difficulties were caused by the high incidence of certain common names and the fragmentary data given by some respondents.

4. A Combat Criterion Data Code Card (NAVPERS 791-Rev. 6-45) (Appendix 3-E) was initiated for each nominee, regardless of whether or not he had been adequately identified. The nominee's name (and when available, the Navy file number) was typed at the top of the card in the spaces provided. (Code C, columns 1 - 28) All such cards were progressively filed alphabetically in such a way that repeated nominations of the same individual could be noted in one place. The checking of the alphabetical file of C.C.D. cards for duplicates frequently provided further leads as to the identification of the nominees. Nominee numbers were printed on the C.C.D. Code cards after a sufficiently large file with a minimal number of duplicates had been accumulated. (However, when a nominee had appeared in previous research samples, e.g., in Phase I studies or in preliminary studies described above, in Chapter I, the previous nominee number was substituted for the new numbers which had been assigned roughly in alphabetical sequence. This will explain the considerable number of gaps in the sequence of numbers. A considerable number of nominees were assigned numbers _after_ the original alphabetical sequence was numbered.)

5. The C.C.D. card was further filled in with information taken from the raw nomination sheets. One of the horizontal lines in the center of the card was used for each nomination of the individual represented by the card. In the column, "Nominations," the respondent number was written or typed, prefixed by the symbols NA (for HIGH nominations) or NB (for LOW nominations), and suffixed by a number (1 or 2) to indicate the _first_ or the _second_ nomination appearing on the raw nomination sheets (whether HIGH or LOW). Thus, NA-10857-1 would mean that _respondent_ number 10857 nominated the individual for the HIGH group, and that this individual was the _first_ named on the "A" side of the nomination sheet. The reasons which were given for the nomination (in accordance with the "A" and "B" lists of reasons) were identified on the card under the appropriate numbered columns of the spaces labeled "Free Response Categories." The reasons initially circled _by the respondent_ were identified by writing "a" or "b" in the appropriate space, leaving other spaces blank. "a" was written in connection with HIGH nominations, and "b" for LOW nominations. The reasons which the respondent gave as "most outstanding" (by putting an X in the circle already made around the code number of the reason) were indicated by _circling_ the letter ("a" or "b") already indicated on the card. Additional nominations (whether HIGH or LOW) beyond the first one indicated on the C.C.D. card were coded in a similar manner on succeeding lines. Thirteen lines are provided on the card; where the number of nominations proved to be larger than thirteen, additional C.C.D. cards were initiated. It should be noted that the order of nominations appearing on the card bears no necessary relation to the order in which they were actually obtained.

6. All names on C.C.D. cards were searched in the AFB main alphabetical file of test and training data variously called File #1 or Code A file. See Appendix 3-L for details of this code. Where available, matching AFB cards were pulled and placed in a separate alphabetical file. Difficulties were encountered in matching the nominees with AFB cards. This was due primarily to the fact that AFB procedures never called for punching the AFB card with the officer file number assigned when a cadet was designated a naval aviator. A few AFB cards initiated for cadets in training late in the war contained enlisted serial numbers, but such cadets rarely appeared in the combat criterion samples, and in any case it was difficult to obtain lists showing both the enlisted and officer numbers of the individuals. The primary basis for matching the cases was simply the individual names. Where this failed, recourse was made to various rosters and lists containing information which afforded a cross-check. The date of designation (as naval aviator) was particularly valuable since it could be relied upon to correspond quite well with the date of training completion punched on the AFB card (columns , in Code A). In any case, AFB cards were matched with the C.C.D. cards only when there was a high degree of confidence that the matching was correct. It is strongly recommended that in any future studies that may be made, adequate procedures be established to identify each individual from the time he enters naval aviation training to the time he appears in criterion samples. For this purpose, it is recommended that there be a positive identification of each individual in terms of his enlisted serial number, his officer file number and his AFB number (the latter being assigned to the individual when he first takes the aviation training selection battery).

7. The spaces on the C.C.D. card labeled "Code C" were further filled out. The name, officer file number, birth date, and nominee number were usually already available on the card. Other data were taken from the materials accompanying the criterion data. These data included information on the nominee's rank, squadron and specialty. In this phase of the study, col. 52 (Code for investigator) was generally left blank. Information available from AFB File #1 cards (training completion data) was <u>not</u> indicated on the C.C.D. code card, in as much as these data were to be mechanically reproduced on the Code C cards.

8. The spaces labelled Code D at the bottom of the C.C.D. code card were filled out. Actually, for this phase of the study, this information was to be put on Code E cards, Code E rather than Code D being associated with data from the check list technique. Space 57 on the C.C.D. Code card was therefore changed to read "E". Cols. 1 - 26 were coded with the number of times each of the categories were indicated by respondents as "most outstanding."*

---

*As noted above, respondents indicated these categories by an X through the code number of the reason, but these categories were called the "circled categories" because they were circled on the C.C.D. Code Card.

Categories were not punched for "mixed" cases (cases receiving both HIGH and LOW nominations) except when a category was used both in the HIGH and LOW sense, in which case a zero was punched. Another set of columns were coded with the number of times categories were used, regardless of whether the category was circled on the C.C.D. code card. Cols. 61-64 were coded with the total number of nominations for the HIGH and for the LOW groups. Generally speaking, all nominations listed on the card were counted, whether from Phase I or Phase II data. As a result, there are some cases in which the frequencies of category use are based on only a part of the nominations totaled in cols. 61-64 of the Code D card. Column 65 was punched with an identification of the group: HIGH, LOW, or MIXED. If, when all nominations were considered, the individual was uniformly placed in the HIGH group, an X (numerical) was coded in space 65. A "1" was coded for those placed in the LOW group by all respondents. "2" was coded for all cases placed in the HIGH group by at least one respondent and also placed in the LOW group by at least one other respondent.

9. Code C and Code E cards were punched from the data given on the C.C.D. code cards.

10. Additional information from AFB file #1 cards was mechanically reproduced in additional columns of the Code C and Code E cards. Dates of training completion and associated data were reproduced on Code C cards, while test data were reproduced in Code E cards. The nominee number carried by both Code C and Code E cards was the only basis of matching the decks. Various other steps (mainly involving machine processing) were taken to make both Code C and Code E cards as complete as possible. The details of these steps will be evident from a study of Code C and Code E given in Appendix 3-J and 3-K. The basic analyses to be reported below were accomplished on the basis of the Code C and Code E decks.

APPENDIX [illegible]

COMBAT CRITERION DATA (CCD) CODE CARD

APPENDIX 3-G

CODE C

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
																C																							
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

STIMULATORS — FREE - RESPONSE - CATEGORIES

NOMINATIONS	200	201	202	203	204	205	206	207	208	209	210	211	212	213		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	100	101	102	103
TOTALS																																																

TOTAL PREV. NOM. — A B
TOTAL HERE —

A B — TOTAL

C.C.D. CODE CARD
NAVMED 791 (REV. 6-45)

CODE D

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
																D																							
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

(P)

COMBAT CRITERION DATA (CCD) CODE CARD

APPENDIX 3-N

CODE C FOR THE COMBAT CRITERION DATA PUNCHED CARD FILE
PRIMARY IDENTIFICATION OF NOMINEES

APPENDIX 3-B

CODE C FOR THE COMBAT CRITERION DATA PUNCHED CARD FILE
PRIMARY IDENTIFICATION OF NOMINEES

Col. of Punch	Col. of Interp.	INFORMATION (Face Card)
1-20	1-20 U	Name
21-28	22-29 U	File No. (Same as Code A)
29-31	31-33 U	Date Birth (Same as Code A)
32-37	35-40 U	ANB No. (Same as Code A)
38	42 U	Education (Same as Code A)
39	44 U	Pre-Flight School (Same as Code A)
40-43	46-49 U	Entering Primary -- Date (40-41) Place (42-43)
44	51 U	Int. or Adv. Station (Same as Code A) -- place where nominee received wings.
45-46	53-54 U	Month and yr. completing training (Same as Code A)
57	60 U	Code Identification (This is Code C, Combat Criterion Data)
47-51	1- 5 L	Nominee number (x-punch added in col. 51 for summary punch cards -- see Code D)
52-61 (note 57 above)	7-17 L	Data from first Investigator:

Investigator	Punch
C. C. Bennett	C (3)
A. C. Hohn	H (8)
J. C. Jenkins	J (1)
J. D. Kaplan	K (2)
V. W. Lyon	V (5)
J. T. Macmillan	M (4)
W. McGehee	G (7)
F. A. Webster	W (6)
Naval Aviation Disposition Bd.	Z (9)

52 (Int. 7) Investigator (same as Code 5)
53-54 (Int. 8-9) Date nominated
55 (Int. 11) Rank

Ensign	1
Lieut.(jg)	2

Lieutenant 3 (Comparable for
Lt. Comdr. 4 Marine Corps)
Commander 5
(x-punch added for reserves)

56-60 (int. 13-16) Squadron When Respondent Knew Nominee, e.g., VTB-103 VF-5

	VTB-103	VF-5
(note	T in col. 56	F. in col. 56
col. 57 above)	1 in col. 58	0 in col. 58
	0 in col. 59	0 in col. 59
	3 in col. 60	5 in col. 60

(Note: VTB was punched "B" by mistake to differentiate VB's from VT's sort on col. 61.)

For VB or VSB squadrons, B in col. 56
For NedRons, D in col. 56
For VOS, S in col. 56
For Air Groups, G in col. 56
For VBF, X (7) in col. 56

(night fighters have numerical x added in col. 58, e.g., if "3" number squadron, add x plus appropriate number. If "0" also belongs in squadron designation record as alphabetical x.)

52-61 7-17 L 61 (int. 17) Specialty (same as Code D)

Specialty	Punch
VC without specialty	S(2)
VF	F(6)
VSB	D(4)
VTB	T(3)
VBF	X(7)
VPB	P(7)
VCVS	R(9)
VB	B(2)
Not classif.	N(5)

(numbers in parentheses show normal punch)

62-70 19-29 L Data from Second Investigator:

62 (int. 19)	Investigator
63-64 (int. 20-21)	Date nominated
65 (int. 23)	Rank
66-69 (int. 25-28)	Squadron
70 (int. 29)	Specialty

71-79 31-41 L Data from Third Investigator:

71 (int. 31)	Investigator
72-73 (int. 32-33)	Date nominated
74 (int. 35)	Rank
75-78 (int. 37-40)	Squadron
79 (int. 41)	Specialty

80 58 L Group
x-High (x in numerical) 1 -- Low 2 -- Mixed

APPENDIX 3-I

CODE FOR THE COMBAT CRITERION DATA
PUNCHED CARD FILE

SUMMARIZED RECORD OF NOMINATIONS,
TEST SCORES, AND TRAINING DATA
FOR CHECK LIST CASES

APPENDIX [illegible]

(CODE [illegible] (COMBAT CRITERION DATA) [illegible] 6-45

Col. of Punch	Col. of Inform.	INFORMATION
1-26	- -	No. of times circled categories used. - - not used. 1-9 times -- as indicated numerically 10 times -- numeric "y" 20 times -- numeric "x" 11 times -- A 21 times -- J 12 times -- B 22 times -- K 13 times -- C 23 times -- L 14 times -- D 24 times -- M 15 times -- E 25 times -- N 16 times -- F 26 times -- O 17 times -- G 27 times -- P 18 times -- H 28 times -- Q 19 times -- I 29 times -- R Categories are not punched on "mixed cases" except when a category is used in both the high and low sense, in which case a ∅ is punched.
27-45 52-[illegible] 58-59 (note 57 below) --		No. of times categories used, regardless of circling. Categories in numerical order. (same code as above).
46-50	1, 5 U	Project serial number-nominees (same project number as in Code C) in cols. 47-50. Col. 46 has "9" punch added to "0" for Marines in "E" deck. (This interprets as a "z").
51	7 U	Rank of nominee as of 1 July 1945 (obtained from BuPers.)

	Punch
Ensign	1
Lieut. (jg)	2
Lieutenant	3
Lt. Comdr.	4
Commander	5 (comparable for Marine Corps)

X-punch added for reserves
(Marines may be distinguished from Naval Officers by "9" in col. 46).

Code E (Cont.)

57	60 U	Code Identification E . . . . . Combat Criterion IBM Card Code
60	18 U	Specialty (see below)
61-64	20-24 U	Number of times nominated For High group . . . 61-62 (int. 20-21; units, tens) For Low group . . . 63-64 (int. 23-24; units, tens)
65	58	Group: x-high (numerical punch) 1-low 2-mixed
66-70	28-32 U	Intelligence test scores (same as Code A).

Specialty:

	Punch		Punch
VF	F(6)	VTB	P(7)
VSB	D(4)	VOVS	R(9)
VTB	T(3)	VR	B(2)
Not classified	N(5)	VPF	X(7) (Alpha)
		VCS	S(2)
		Nominees from training	J(1)

(Numbers in parentheses show normal punch)

a. Men accepted for training up to Oct 8, 1942
   66-67 (int. 28-29 .. Personnel Test (raw score on first test)
   68-69 (int. 30-31 .. Personnel Test (raw score on second test)
   70 (int. 32 ..... Letter grade on Personnel test (recorded June 1 -- Oct 8, 1942. ACT letter is in same col. for later cases.)

b. Men accepted for training since Oct 8, 1942
   66 (int. 28) .... ACT Form (Form 1 or 2 coded as A or B to distinguish from PT scores. Numeric "x" punched, but not interpreted if form unknown)

Code E (cont.)

67-69 (int. 29-31)..ACT raw score
70 (int. 32).....ACT letter grade (if forms 3,4, or 5 of MCT used, see col. 74 -- letter grade is based upon stand of 2-1-43.).

71-74 34-37 U MCT data

71-72 (int. 34-35).....Raw score. (All scores converted to "rights" only)

73 (int. 36).....MCT letter grade. (Letter grade is based upon Feb. 1, 1943 or later definition.)

74 (int. 37).....MCT form (Forms 2,3,4 and 5).

75 39 U BI letter grade. (Based upon 1 January 1943 key -- the "W" key -- and letter grade definition).

76 41 U Flight aptitude rating (FAR) based upon "W" BI key.

77-78 43-44 U BI Raw Score

Zero scores have a "y" punch in "tens" column (i.e., col. 77) ("y" punch in col. 78 indicates oldest form of BI used, i.e., 1941 edition -- was administered.)
Y-punch is numerical

79 -- Blank.

80 Gross specialty classification.

X SE's (x-punch is numerical)
1 ME's
2 Not classified.

APPENDIX 3-J

CODE A, FOR THE MAIN AND ALPHABETICAL FILE FOR TEST SCORES AND TRAINING STATUS OF AVIATION CADETS

APPENDIX 3-J

CODE A   9-1-44

Col. of Punch	Col. of Interp.*	INFORMATION
1	24 U---	MO. OF TESTING 1---Jan 7---July 2---Feb 8---Aug 3---Mar 9---Sept 4---Apr O---Oct (corrected) 5---May N---Nov 6---June D---Dec
2	25 U---	YEAR OF TESTING (LAST DIGIT)

3-10	21-28 U---	FILE OR SERVICE NUMBER
		
		Navy
		Officers.........NO------ (six digits)
		Enlisted.........O------- (seven or eight
		                 -------- digits)
		
		Marine Corps
		Officers.........MCO----- (five digits)
		Enlisted.........MC------ (six or seven
		                 M------- digits)
		
		Coast Guard
		Officers.........CG------ (six blanks)
		Enlisted.........CO------ (six or seven
		                 C------- digits)
		
		(No punch in col. 3 indicates status unknown.
		All "O" punches are numerical.)

11	30 U---	MONTH OF BIRTH (Same code as col. 1)
12-13	31-32 U---	YEAR OF BIRTH (LAST TWO DIGITS)
14-19	37-42 U---	AVIATION PSYCHOLOGY SERIAL NUMBER.
20		....
21-40	1-19 U---	NAME

*"U" means upper line interpretation, "L", lower line interpretation.

Col. of Punch	Col. of Interp.	INFORMATION
41-45	44-48 U---	INTELLIGENCE TEST SCORE

A. Men accepted for training up to Oct. 8, 1942

41-42 (Int. 44-45---Personnel Test(raw score on first test).

43-44 (Int. 46-47---Personnel Test(raw score on second test).

45 (Int. 48)----Letter grade on Personnel Test (recorded June 1 -- Oct. 8, 1942. ACT letter grade is in same column for later cases.)

B. Men accepted for training since Oct. 8, 1942

41 (Int. 44)-- ACT form (Form 1 or 2 coded as A or B to distinguish from PT score. Numeric "x" punched, but not interpreted if form unknown)

42-44 (Int. 45-47)-- ACT raw score

45 (Int. 48) -- ACT letter grade. (If Forms 3, 4, or 5 of MCT used- see col. 49 - Letter grade is based upon ACT standardization of Feb. 1, 1943)

46-47 — 50-51 U-- MCT RAW SCORE. (If letter grade is punched - see col. 48 - raw score is "rights". If no letter grade is punched, raw score is R-½ W.)

48 — 52 U-- MCT LETTER GRADE. (If "F" is in col. 52 - Interp. 57 - MCT Letter grade is based upon definition prior to Feb. 1, 1943; if W, X, Y, or Z is punched in Col. 52, letter grade is based upon Feb. 1, 1943 definition.)

49 — 53 U-- MCT FORM* (Forms 3, 4, and 5; if no punch and no FAR, Form 2)

50 — 54 U-- PI LETTER GRADE (Standardization upon which letter grade is based is indicated in col. 52. No letter grade assigned on PI for May 15, 1944, standardization.)

51 — 55 U-- FLIGHT APTITUDE RATING (FAR). FAR scale prior to May 15, 1944 standardization punched alphabetically. FAR scale for May 15, 1944 standardization punched numerically as follows:

9---A	4---C-
8---A-	3---D
7---B	2---D-
6---B-	1---E
5---C	

---

*Some Form 2 MCT letter grades are based upon Feb. 1, 1943 standardization.

Col. of Punch	Col. of Inform.	INFORMATION
52	57 U---	BI KEY V---standardization prior to Feb. 1, 1943 W---standardization of Feb. 1, 1943 X---standardization of May 15, 1944 Y--- " " " Z--- " " "
53-54	58-59 D---	BI RAW SCORE (punched for May 15, 1944 standardization, not before.)
55-56	1-2 L---	SELECTION BOARD ONOP (SBONOP) 15 Atlanta 11 Boston 19 Chicago 18 Dallas 20 Detroit 23 Kansas City 24 Los Angeles 21 Minneapolis 17 New Orleans 12 New York 13 Philadelphia 25 San Francisco 26 Seattle 22 St. Louis 14 Washington 30 Tested at sea or on shore stations not within U. S. 31 Tested on continental U. S. but not at ONOP
57	60 U---	CODE IDENTIFICATION A 9-1-44 Code
58	...... --	EDUCATION 0 Not graduated from H. S. 1 High School graduate (Less than 2 yrs. college) 2 2 or more yrs. of college

Col. of Punch	Col. of Interp.	INFORMATION
59	60 L---	STATUS AT TIME OF SELECTION OR IMMEDIATELY BEFORE MAN ENTERED TRAINING.

	*Punch
Officer, USN or USNR	1
" , USMC or USMCR	2
" , USCG or USCGR	3
" , Special, Flight Surgeon, A-V(T's), etc.	4
Civilian	5
Enlisted, USNR	6
" , USN	7
" , USMC or USMCR	8
" , USCG or USCGR	9
Foreign officer or enlisted	0
Enlisted USN or USNR (not differentiated)	x
Unknown	y

*Numeric "y" punch added when man tested after being selected, e.g. if tested at some stage in training. Obviously, a letter will be interpreted when both normal and zone punches are used. x-punch not used when man tested in training, the small group with USN - USNR differentiation not made being punched "y" only.

Col. of Punch	Col. of Interp.	INFORMATION
60-61	56-57 L---	STAGE OF FAILURE

00 Passed
1x Elimination
2x Primary A
3x " B
4x " C
5x " D
6x " E
7x " F
8x Intermediate basic
9x Intermediate advanced
xx Primary, stage unknown
1y In pool at primary Base, "Awaiting Flight Training", or Post-Graduate status at PreFlight.

11 Academic Refresher Unit
y1 Flight Prep School
y2 WTS-CAA
y3 Pre-Flight School
y4 Air Navigation
y5 Lighter-than-Air
y6 Accepted under quota but did not enter training
y7 Tarmac
y8 V-12 (a) college
yy Stage Unknown
y9 Is known to have been rejected in the process of selection. Punched since 1 June 1944.

Col. of Punch	Col. of Interp.	INFORMATION
62	58 L---	REASON FOR FAILURE

0 Passed
1 Flight
2 Psychologically unsuited
3 DOR (Drop at own request)
4 Physical training
5 Disciplinary (Marriage)
6 Ground training, academic
7 Killed in crash (Note: if awarded posthumous commission code as passed)
8 Not officer material, unsuited for commission
9 Not physically qualified on routine physical examination
x Other medical reasons, including death
y Other reasons, or unknown
A Dropped due to cut-back in training program July 1944*
C D.O.R. at time of cut-back in training program July 1944*

* These men are eligible for reenlistment.
(x and y punches are numeric.)

Col. of Punch	Col. of Interp.	INFORMATION
63-64	52-53 L---	MONTH AND YEAR OF COMPLETING OR FAILING TRAINING (Same code as for cols. 1 and 2)
65-66	3-4 L---	MONTH AND YEAR OF ENTERING TRAINING PROGRAM (Same code as for cols. 1 and 2)
67	5 L---	STAGE OF ENTRY INTO TRAINING PROGRAM

1 V-12(a)
2 Academic Refresher Unit
3 Flight Preparatory School
4 CAA-WTS
5 Preflight School
6 Elimination Training Station
7 Primary Training Station
8 Lighter-than-Air
9 Unknown

Col. of Punch	Col. of Interp.	INFORMATION
68-69	7-8 L---	MONTH AND YEAR OF ENTRY INTO FLIGHT PREPARATORY SCHOOL OR ACADEMIC REFRESHER UNIT (Same code as for cols. 1 and 2)

Classes entered NFPS from Jan 1943 to July 1944. Classes entered ARU's beginning in July 1944.
R in 68 indicates Battalion 10 entering NFPS Sept. 30, 1943.

Col. of Punch | Col. of Interp. | INFORMATION

70 9 L--- FLIGHT PREPARATORY SCHOOL OR ACADEMIC REFRESHER UNIT

A Colgate Univ. (Hamilton, N. Y.)
B Cornell College (Mt. Vernon, Iowa)*
C DePauw Univ. (Greencastle, Indiana)
D Louisiana State Normal (Natchitoches, La.)*
E Monmouth College (Monmouth, Ill.)*
F Murray State Teachers College (Murray, Kentucky)*
G Ohio Wesleyan (Delaware, Ohio)
H Rensselaer P. I. (Troy, N. Y.)
J St. Olaf's College (Northfield, Minn.)*
K California Polytechnic School (San Luis Obispo, Calif.)*
L Univ. of Pennsylvania (Philadelphia, Pa.)
M Univ. of Southern California (Los Angeles, Calif.)
N Univ. of South Carolina (Columbia, S.C.)
P Univ. of Texas (Austin, Texas)
Q Univ. of Virginia (Charlottesville, Virginia)
R Univ. of Washington (Seattle, Washington)
S Wesleyan Univ. (Middletown, Conn.)
T Williams Jewell College (Liberty, Missouri)*
U Williams College (Williamstown, Mass.)
V College of Wooster (Wooster, Ohio)*
* Function as Academic Refresher Units beginning July 1944

71-72 11-12 L--- MONTH AND YEAR OF ENTRY INTO PREFLIGHT SCHOOL
(Same code as for cols. 1 and 2).

73 13 L--- PREFLIGHT SCHOOL

1 North Carolina (Chapel Hill)
2 Georgia (Athens)
3 Iowa (Iowa City)
4 St. Mary's (Moraga, Calif.)
5 Del Monte (Calif.)

74-75 15-16 L--- MONTH AND YEAR ENTERING PRIMARY TRAINING.
(Same code as for cols. 1 and 2.)

Col. of Punch	Col. of Interp.	INFORMATION
76-77	17-18 L---	PRIMARY TRAINING STATION
78-79	20-21 L---	MONTH AND YEAR OF ENTERING INTERMEDIATE TRAINING. (Same code as for cols. 1 and 2.)
80	22 L---	INTERMEDIATE OR ADVANCED TRAINING STATION (WHERE WINGS RECEIVED)

76-77 — 17-18 L--- PRIMARY TRAINING STATION

01 Pensacola
02 Jacksonville — When these were
03 Miami — elimination bases
04 Corpus Christi
11 Boston (Squantum) Mass.
12 Floyd Bennett, N.Y.
13 Philadelphia, Pa.
14 Anacostia, D. C.
15 Atlanta, Ga.
16 Miami, Fla.
17 New Orleans, La.
18 Dallas, Texas
19 Chicago (Glenview) Ill.
20 Detroit (Grosse Ile) Mich.
21 Minneapolis, Minn.
22 St. Louis (Robertson) Mo.
23 Kansas City (Olathe) Kansas
24 Los Alamitos (formerly Lg. Beach, Calif.
25 Livermore (formerly Oakland) Calif.
26 Pasco (formerly Seattle) Wash.
27 Memphis, Tenn.
28 Bunker Hill (formerly Peru) Ind.
29 Hutchinson, Kansas
30 Norman, Oklahoma
31 Ottumwa, Iowa
32 Lakehurst,
33 Moffett Field, Calif. (LTA)
50 Credited with Navy Primary Training at Advanced CAA.

78-79 — 20-21 L--- MONTH AND YEAR OF ENTERING INTERMEDIATE TRAINING.
(Same code as for cols. 1 and 2.)

80 — 22 L--- INTERMEDIATE OR ADVANCED TRAINING STATION (WHERE WINGS RECEIVED)

1 Pensacola
2 Jacksonville
3 Miami
4 Corpus Christi
5 New Orleans
6 Moffett Field
7 Lakehurst, N. J.

APPENDIX 5-A

A TECHNICAL NOTE ON THE RELIABILITY OF NOMINATIONS IN SPECIFIC CATEGORIES

by

J. B. Carroll

APPENDIX 5-A

Table 5.9 shows reliabilities for nominations for "High" or for "Low" in specific categories or "reasons" for the nominations. It will be recalled that the nominators were asked to check (1) all the reasons for their nominations, and (2) the one, two, or three reasons which were most important. The reliability of either method of appraisal may be determined by assuming that each nominee can be regarded as having a "true score," with respect to a certain category, somewhere between zero and unity. The nominee who is nominated for a certain category (by one of the above methods of appraisal) uniformly by a universe of respondents would, then, have a true score of unity; conversely, the nominee who is never placed in a specific category by a universe of respondents is regarded as having a true score of zero for the category.

The method which was used is based upon an analysis of variance among and within nominees who were nominated at least twice for the over-all High or Low groups. (The method can also be extended to restrict the study to nominees receiving a number of nominations at least as great as any specified number, merely by excluding cases with less than the required number of nominations.)

To illustrate the method, let us assume that we have 10 nominees nominated two or more times for the High group, and that we wish to determine the reliability with which those nominees were placed in Category 7 (in this case by the first method of appraisal, i.e., placement in the category regardless of whether it was the most important category). We assign the value "1" to placement in the category, and "0" to non-placement in the category. The raw data and preliminary calculations are shown in Table 5-A1.

The reliability of a single "score" (i.e., a category placement by one nominator) can be found as follows:

$$r_{11} = 1 - \frac{\text{"Within nominee" variance}}{\text{total variance}} = 1 - \frac{.1890}{.2509} = .2467.$$

These computations can be reduced to the following formula, which can be used as a basis for large-scale computations from punched-card data:

$$r_{11} = 1 - \frac{\left[\Sigma n - \Sigma\left(\frac{n^2}{N_g}\right)\right]\left[N - 1\right]}{\left[\Sigma n - \frac{(\Sigma n)^2}{N}\right]\left[N - k\right]};$$

in which r_{11} = the reliability of a single score;

n = the number of times the nominee is placed in a category;

N = the total number of measurements, for the total group of nominees (thus, equivalent to the total number of nominations for High or for Low received by all the High nominees or the Low nominees, the High and Low groups being studied separately);

TABLE 3-A 1

EXAMPLE OF RAW DATA AND PRELIMINARY CALCULATIONS

Nominees	Category "Scores" (as assigned by various nominators)	No. of Nominators N_p	No. of Placements in Cat. "I"* $\Sigma X = n = \Sigma X^2$	n^2	$\frac{n^2}{N_p}$
1	0 1 1	3	2	4	1.333
2	0 0 0 0 1 0	6	1	1	.167
3	1 1 1 1 1 1 1 1	8	8	64	8.000
4	0 1 0 0 1 1 0	7	3	9	1.286
5	1 1	2	2	4	2.000
6	0 1 1	3	2	4	1.333
7	0 0 1 1 0 1	6	3	9	1.500
8	1 1	2	2	4	2.000
9	0 0	2	0	0	.000
10	1 0 0	3	1	1	.333
		42	24		17.952
$k = 10$ (no. of nominees)		$= N$ (total no. of measurements)	$= \Sigma n$		$= \Sigma\left(\frac{n^2}{N_p}\right)$

"Correction term" $= \frac{(\Sigma n)^2}{N} = 13.71$

*In the usual analysis of variance problem, it is necessary to find both the sum and the sum of squares of individual scores. In this case, however, since all individual scores are either 0 or 1, the sum of individual scores is equal to the sum of squares of individual scores. Therefore, in the last column,

$\frac{n^2}{N_p} = \frac{(\Sigma X)^2}{N_p}$, in the more usual notation.

The analysis of variance table derived from these data is as follows:

Source of Variance	S. S.	d. f.	Mean Square
Among nominees	4.242	$(k - 1) = 9$	(.4713)
Within nominees	6.048	$(N - k) = 32$	.1890
Total variance of measurements	10.290	$(N - 1) = 41$	.2509

N_p = the number of measurements for a particular nominee, i.e., the number of times nominated for the High or Low group, regardless of category;

k = the number of nominees in the sample.

As pointed out, the above computations give only the reliability of a category assignment by a single nominator. In view of the fact that many cases received multiple nominations, the reliability of category placements by a number of nominators might be estimated by means of the Spearman-Brown prophecy formula, using the actual number of nominations as the "number of times the test is lengthened" in that formula.

APPENDIX 7-A

TRANSFORMATION MATRICES FOR HIGH AND LOW ANALYSES

APPENDIX 7-A

TRANSFORMATION MATRIX FOR HIGH GROUP

Category	A	B	C	D	E	F	G	H	K
1.	16	16	22	12	10	11	14	21	13
2.	-54	29	15	-13	-19	16	35	-22	20
3.	-49	42	-22	19	30	-15	-22	-13	02
4.	23	28	-60	48	-54	-50	37	-34	15
5.	52	65	07	-47	-15	12	-44	-22	06
6.	-12	22	-43	-42	-21	32	-22	78	18
7.	01	22	28	-33	15	-81	49	28	21
8.	31	14	-46	-39	48	02	43	01	-48
9.	-10	32	22	03	-51	-10	-06	13	-78

TRANSFORMATION MATRIX FOR LOW GROUP

Category	A	B	C	D	E	F	G	H	K
1.	29	27	21	21	31	24	32	23	01
2.	-20	27	-12	-16	-27	27	[illegible]	-30	-02
3.	-32	28	-20	31	-39	-51	-03	22	-01
4.	56	05	01	-50	-26	-35	42	05	-13
5.	-17	53	30	-52	67	-28	-34	-27	13
6.	36	05	-73	-05	12	-45	-08	-52	-06
7.	29	-09	52	39	-34	01	-11	-69	-08
8.	-38	-62	07	36	21	-43	80	-25	09
9.	26	31	04	17	00	-13	03	00	98

APPENDIX 7-B

COSINE MATRICES FOR THE HIGH AND LOW ANALYSES

APPENDIX 7-B

COSINES OF ANGLES BETWEEN FACTORS FOR HIGH GROUP

Category	A	B	C	D	E	F	G	H	K
A.	1.00	.06	-.15	-.21	-.01	-.05	-.03	-.08	-.12
B.		1.00	-.16	-.33	-.27	-.24	-.05	-.05	-.06
C.			1.01	-.10	.04	.08	-.10	.01	.00
D.				.99	-.27	-.09	.05	-.46	.05
E.					1.01	.10	.11	.03	.05
F.						1.01	-.54	.00	-.10
G.							1.00	-.09	.03
H.								.99	-.03
K.									1.00

COSINES OF ANGLES BETWEEN FACTORS FOR LOW GROUP

Category	A	B	C	D	E	F	G	H	K
A.	1.00	.15	-.02	-.20	-.13	.00	.00	-.14	.10
B.		1.00	.01	-.41	.15	.03	-.41	.09	.31
C.			1.00	.11	.12	.35	.08	-.04	.09
D.				1.00	-.29	.02	.14	-.[illegible]	.17
E.					1.00	-.04	.07	-.03	.27
F.						1.00	-.26	.25	-.13
G.							1.00	-.04	.10
H.								1.00	.02
K.									1.00

APPENDIX 8-A

SOCIOMETRIC DIAGRAMS FOR A VF AND A VP SQUADRON

APPENDIX 8-A

SOCIOMETRIC DIAGRAMS FOR A VF AND A VP SQUADRON

The interrelationships among respondents and nominees within given squadrons were determined and diagrammatically represented in terms of an adaptation of the schematic technique developed by Moreno.[1] The two diagrams which follow represent diagrammatic presentations of the patterns of nominations within a VF and a VP squadron, respectively.

An explanatory legend is given on each diagram. As indicated in the legend the rank of the nominee or respondent is shown by the number of rings in the circle representing each nominee or respondent.[2] The nominations are denoted by lines, a line ending in an arrow indicating that the individual was nominated High; a line ending in a small circle indicating that the individual was nominated Low. It might also be noted that the larger circles represent nominees who in some cases were also respondents. The smaller circles represent respondents who were not nominated from within the squadron. Nominations of officers outside of the squadron are indicated by extension of the "nomination lines" outside the "squadron boundary." However, nominations of officers within the squadron by respondents outside the squadron are not given in the diagrams.

Although on the basis of these diagrams no definitive conclusions can be drawn, certain points are of interest, particularly in comparing the diagrams for the two squadrons. First, respondents in the VF squadron nominated more officers outside the squadron than did respondents in the VP squadron. In the VF squadron 26 Low, and 16 High nominations were made of men outside the squadron boundary. In the VP squadron three High, and one Low nomination were made of men outside the squadron.

In both squadrons there is a concentration of nominations on certain individuals, although in the VF squadron this concentration was particularly with reference to High nominees, in the VP squadron with reference both to Highs and to Lows, the multiply nominated Lows including officers of relatively high rank (Lieutenants and Lieutenant Commanders). In the VF squadron there is little evidence of "reciprocal nominations" for High (or for Low). That is, there is little or no evidence that a respondent who nominates another officer for High is in turn the recipient of a High nomination from the officer in question. There is, however, an instance of a High-Low reciprocal nomination, i.e., Lieut.(j.g.) 10 nominates Lieut. Comdr. 43 for High, whereas Lieut. Comdr. 43 nominates Lieut.(j.g.) 10 for Low.

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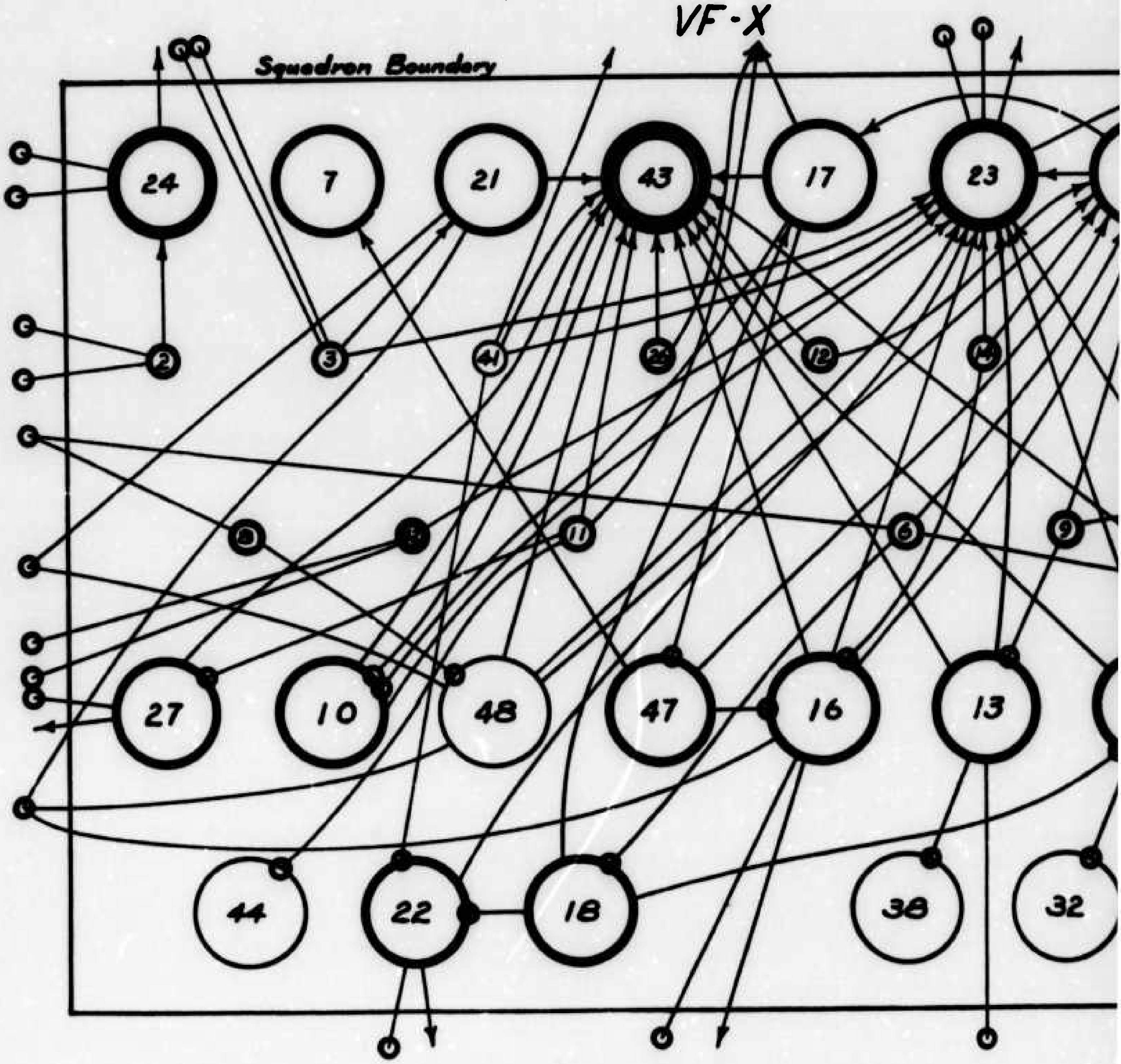
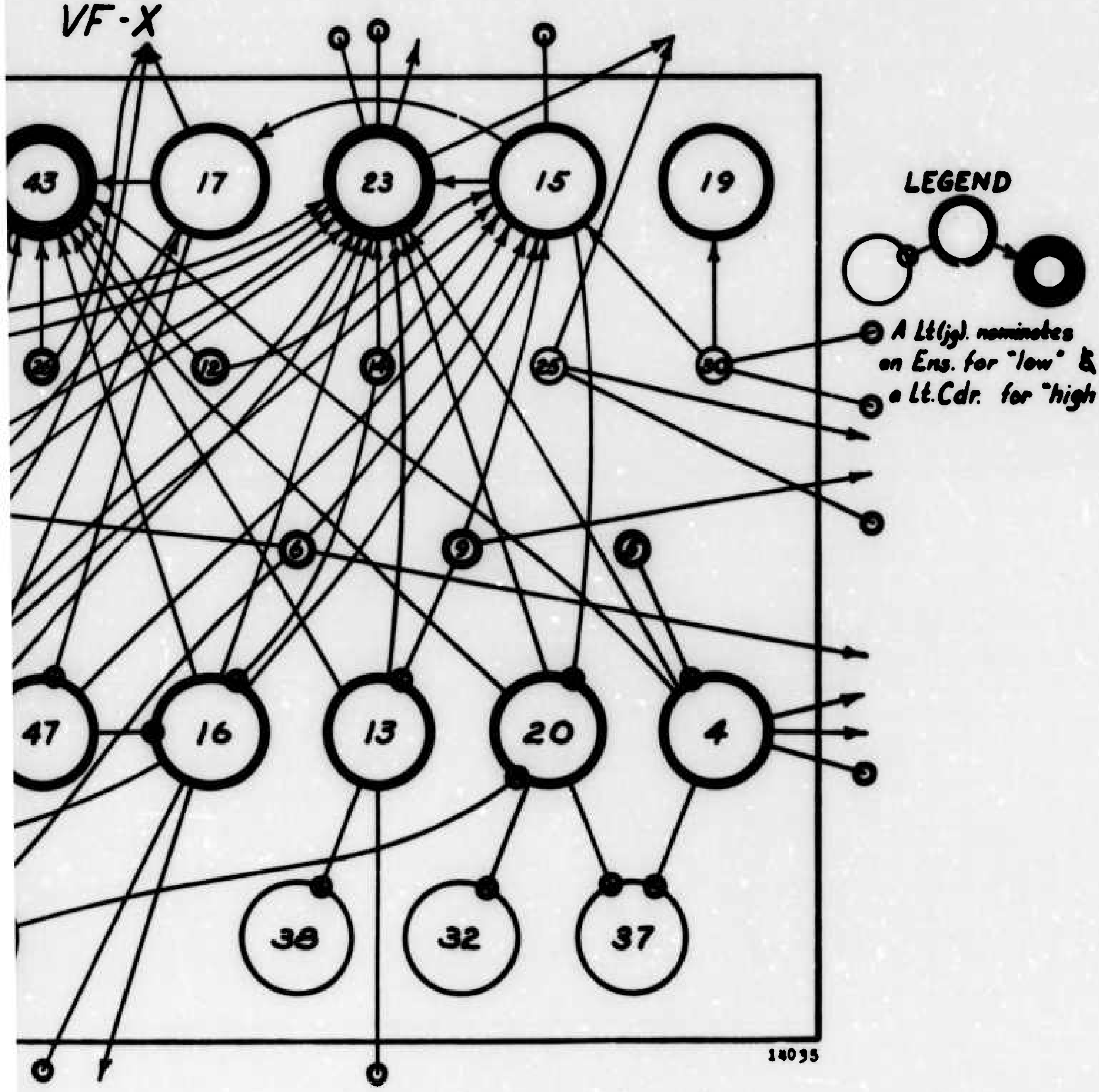
[1] Moreno, J. L., Who shall survive? A new approach to the problem of human interrelations. Washington, D.C.: Nervous and Mental Disease Publishing Company, 1934.

[2] One ring denotes Ensign; two, Lieutenant(j.g.); three, Lieutenant (senior grade); and four, Lieutenant Commander.

As might be suspected from the fewer number of nominations outside the squadron, the intra-squadron relationships for the VP squadron are somewhat more complex than for the VF squadron. There are a number of evidences of reciprocal nominations for High, i.e., 176-213, 204-182, 184-177, 205-182. There are also some reciprocal nominations for Low, i.e., 178-179, 201-202. In neither squadron, however, is there any trend indicating that Low nominees tend themselves to nominate, for Low, officers whom other respondents nominate for High. In this connection the Low nominations of "Mixed" nominees appear as readily to come from respondents who are High nominees, or from non-nominated respondents, as from Lows. There is no evidence that respondents who are themselves Low nominees tend, out of spite or for some other reason, to nominate for Low officers whom their mates consider of High nomination caliber.

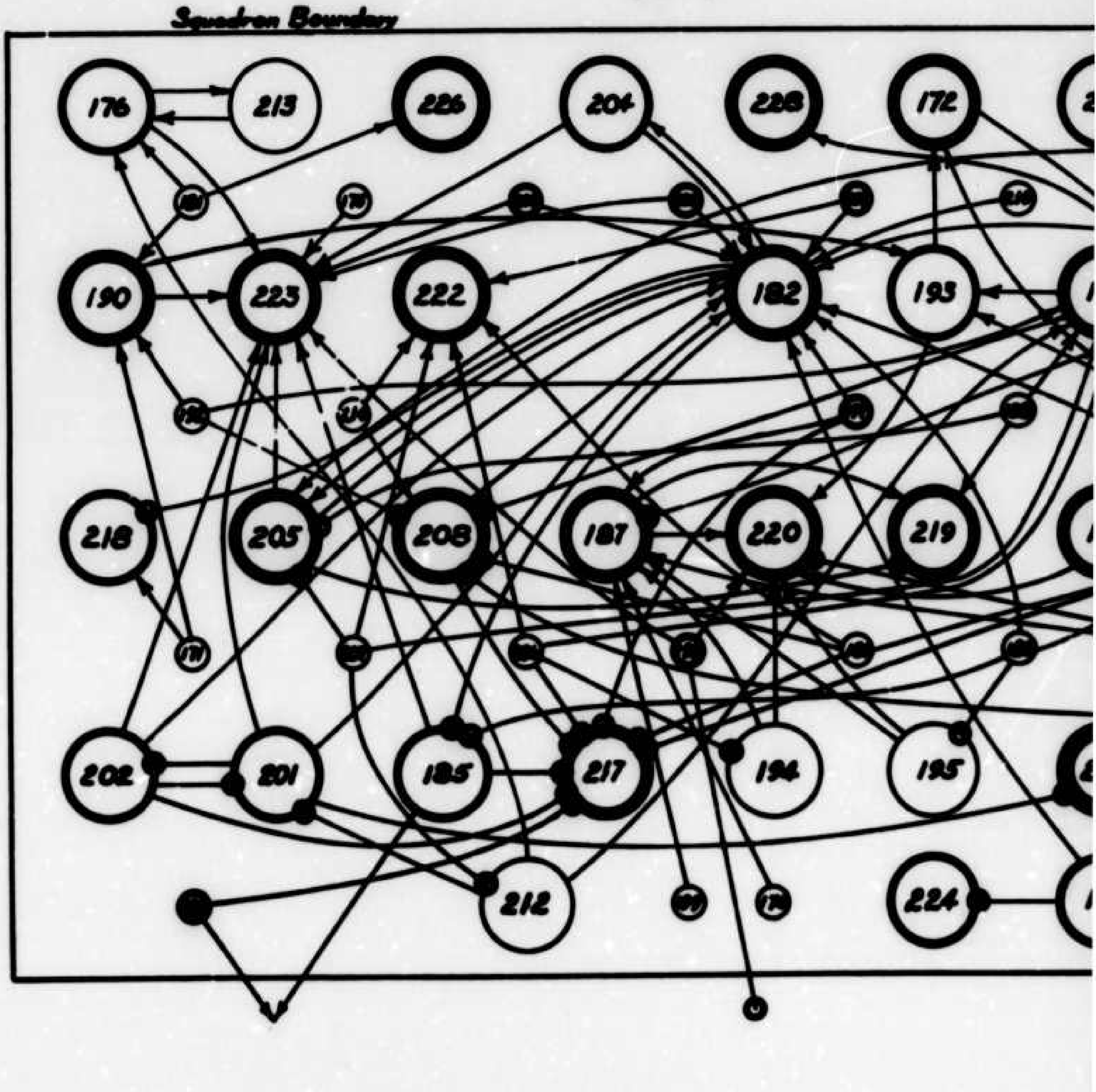
On the basis of comparison of the two sociometric diagrams one might hazard the guess that the interpersonal relationships, and thus probably the morale, were of a higher quality in the VF than in the VP squadron, there being relatively more Low nominations outside than inside the squadron, fewer mixed nominations, and fewer reciprocal nominations.


VF-X
Squadron Boundary
24
7
21
43
17
23
2
3
41
12
11
6
9
27
10
48
47
16
13
44
22
18
38
32

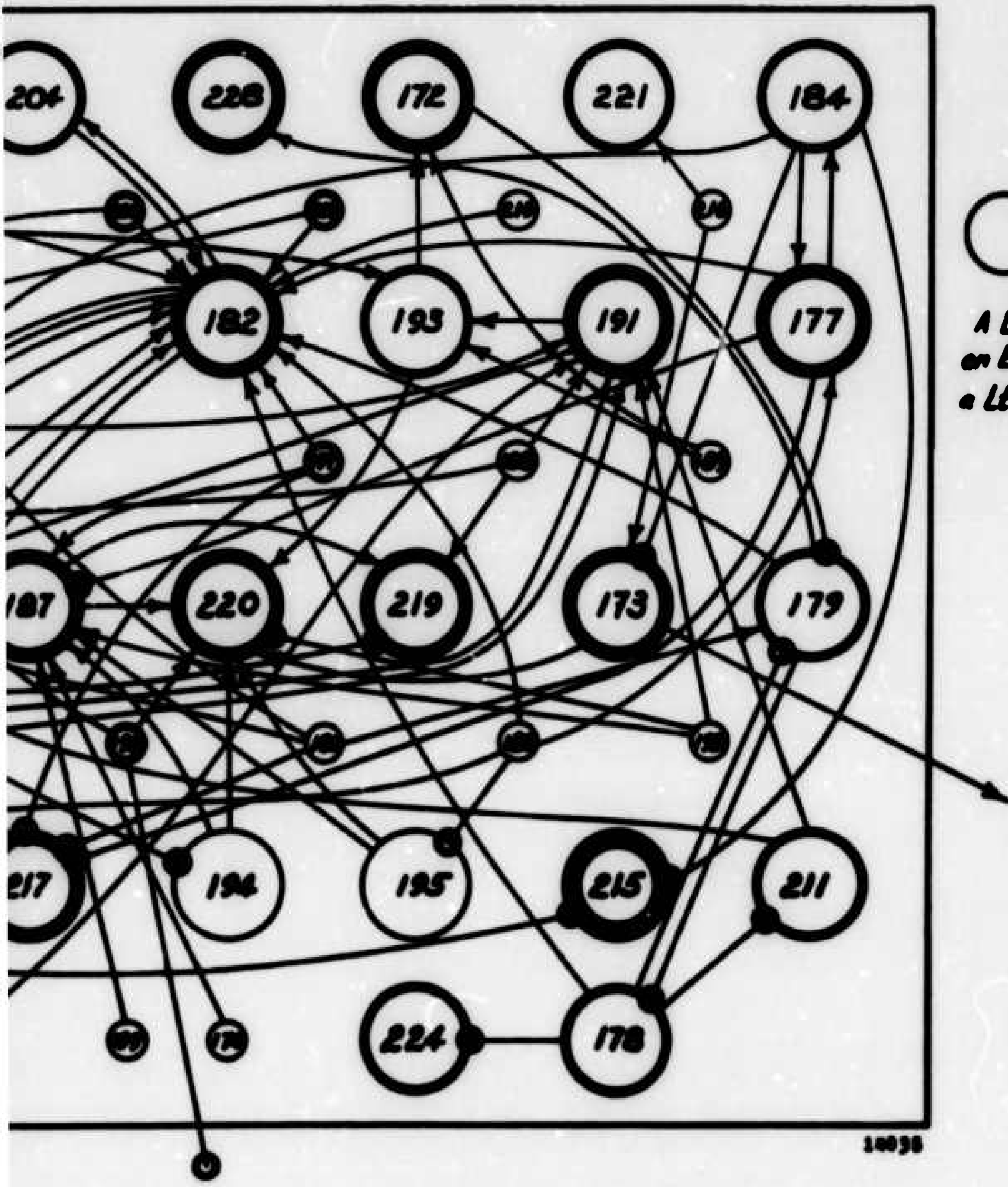

VF-X
43
17
23
15
19
LEGEND
A Lt(jg). nominates an Ens. for "low" & a Lt.Cdr. for "high".
12
14
25
30
6
9
47
16
13
20
4
38
32
37
14095

B

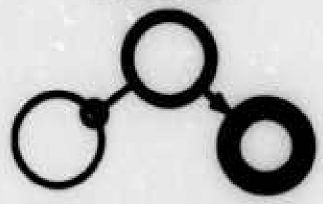
VP-Y


Squadron Boundary
176
213
226
204
228
172
190
223
222
182
193
218
205
208
187
220
219
202
201
185
217
194
195
212
224

VP-Y



LEGEND



A Lt(jg). nominates an Ens. for "low" & a Lt.Cdr. for "high."

B

APPENDIX 8 B

EVALUATION OF LEADERSHIP AND ASSOCIATED QUALITIES IN PRE-FLIGHT SCHOOL BY MEANS OF THE NOMINATING TECHNIQUE

From a Report
Prepared by

Charles L. Vaughn

APPENDIX 8-B

EVALUATION OF LEADERSHIP AND ASSOCIATED QUALITIES IN PRE-FLIGHT SCHOOL BY MEANS OF THE NOMINATING TECHNIQUE

I. Purpose:

At the request of CNO a preliminary study has been made of the feasibility of using the nominating technique at pre-flight schools for evaluating leadership and associated qualities of aviation cadets and student aviation pilots.

II. The Nominating Technique:

The nominating technique was utilized by the Aviation Psychology Branch, BuMed, to obtain two groups of pilots, one whose performance in combat had been judged to be exceptionally outstanding, and another whose performance showed undesirable characteristics. These groups were sought as a basis for validating tests used in the selection of aviation cadets. As used in combat the method is as follows:

> Combat-experienced pilots are asked to name: (a) two men upon whom they would want to fly wing in combat, and (b) two men whom they would not want flying wing on them in combat. After submitting their nominations, the respondents are asked to give the reasons for each of their four choices.

Besides the HIGH and LOW criterion groups, the nominating technique has yielded material of unexpected value in the reasons given by the pilots for wanting and not wanting other pilots in their combat teams. These reasons have been analyzed and coded into some 30 categories, which provide a picture of personal characteristics desired and not desired in combat pilots.

Although many of the reasons given by the combat-experienced pilots for their nomination refer to the way in which the nominees handle the airplane, many of the characteristics were observable aboard ship and ashore. On a priori grounds the pre-flight situation would seem to provide an excellent opportunity for appraising such characteristics early in training, since members of a platoon live, study, attend classes, drill, and participate in athletics with each other for 26 weeks.

III. The Initial Exploration:

On the basis of the reasons given by the combat pilots for their nominations, nine questions were formulated to elicit HIGH and LOW nominations of pre-flight cadets. Two officers (one from APB, BuMed, and one from P&WT, CNO) tried these questions out in interviews with 52 cadets (two platoons) who had been aboard at the Athens Pre-Flight School for 21 weeks.

Six of the nine questions were specific in purpose and were aimed at appraising the following characteristics:

1. Leadership
2. Team-play
3. "Sticking out one's neck for a shipmate"
4. Willingness to accept criticisms and suggestions
5. Judgment and willingness to accept responsibility
6. Desire to fly

Three questions rather more general than the first six, were aimed at evoking over-all evaluations. The nine questions are given in Appendix I.

It was emphasized in explanations to the cadets that the project was purely for research purposes, and that no administrative action would be taken on the basis of their statements about any individual. The primary purpose of the initial exploration was to determine what type of reasons the cadets would give for their nominations, although it was also important to know whether there would be a fairly high order of agreement in choosing one or two men for the respective groups and whether the cadets would accept the task with a fair degree of seriousness and approval.

Briefly, the initial results may be summarized as follows: One or two men were singled out for low nominations and a corresponding number for high choices in each platoon, some questions, of course, being superior to others in this respect. On the whole, the reasons appeared to correspond to those given by the combat pilots, except that no reference was made by the pre-flight cadets to the air situation. The reasons given for the nominations in answer to Question 1, (see Appendix I) however, appeared to cover most of the categories which it seemed possible to identify at the pre-flight level, but the subjects tended to place a rather heavy emphasis upon experience in leading ground troops prior to entering the aviation training program. Question 1 also seemed to provoke the least resistance in giving low nominations.

In view of the apparent coverage afforded by this question, its acceptability, and the obvious need to reduce the length of the questioning period, it was decided to revise Question 1 and adopt it as the means of obtaining the nominations. At the same time it was decided to cast the task in the form of a written questionnaire so that a large number of cadets could be polled during one period.

IV. The Group Study:

The Questionnaire Method. -- Question 1 was re-formulated in such a way as to evoke nominations on the basis of observations made by the cadets in pre-flight school alone, eliminating in so far as possible inferences from a knowledge of the others' previous military experience, or judgments as to the qualities required in flight training proper or in combat. As revised the question read thus:

"Assume you were to organize a new platoon in Pre-Flight School:

"What two men in your present platoon would you select as leaders for the new one"?

"What two men in your present platoon would you least desire as leaders of the new platoon"?

Reasons for the nominations were also requested.

To this question two others were added, the second in the hope of obtaining nominations solely on the basis of "team-play" since leadership was emphasized by the first question; and the third, to obtain a wider coverage of cadet attitude towards the pre-flight program. The three questions were mimeographed with a brief introduction and spaces for identifying information and were administered to the remaining four platoons (104 men) of the battalion. The questionnaire is shown in Appendix II.

The results were then analyzed to determine: (a) whether one or two men would be singled out in each platoon as exceptional; (b) whether the reasons given for the nominations would be akin to those given by the combat pilots; and (c) whether the cadets agreed with the platoon and company officers in their choices of extreme cases. The remainder of this report deals primarily with the analysis of results with Question I. Question II proved to be unexpectedly ambiguous,[1] and complete analysis of the results with it was consequently not made. A report on the results with Question III will be submitted later.

The Distribution of Nominations. -- Figure 1 is a graphic illustration of the agreement between cadets in choosing men for the HIGH and LOW groups in answer to Question I. In Platoon No. 3 the lowest man received 22 out of 30 possible nominations for the Low group. In Platoon Nos. 1 and 4 the nominations were not concentrated quite so heavily on the LOWS, but the extreme cases on the low side in both platoons were chosen by at least half of the members of the platoons for the Low groups. The situation is similar for the high end of the scale. In no instance was an outstandingly High or Low case nominated for both the HIGH and LOW groups.

Analysis of Reasons Given. -- The reasons given for the nominations were analyzed by the method used with the combat criterion data. First,

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[1]Several of the cadets seemed to feel that they should show good sportsmanship in answering Question II by balancing the opposing teams with good men on both sides. For example, a cadet nominated seven times for the High Group was chosen once for the presumed Low Group for the following reasons "He is clever and eager and would add to the interest of the game with competition." This is a dramatic illustration of the need for preliminary exploration before the method is crystallized.

FREQUENCY OF NOMINATION OF MEN IN EACH PLATOON - GROUP TECHNIQUE
Battalion 65 (21 weeks aboard)
Question No. I

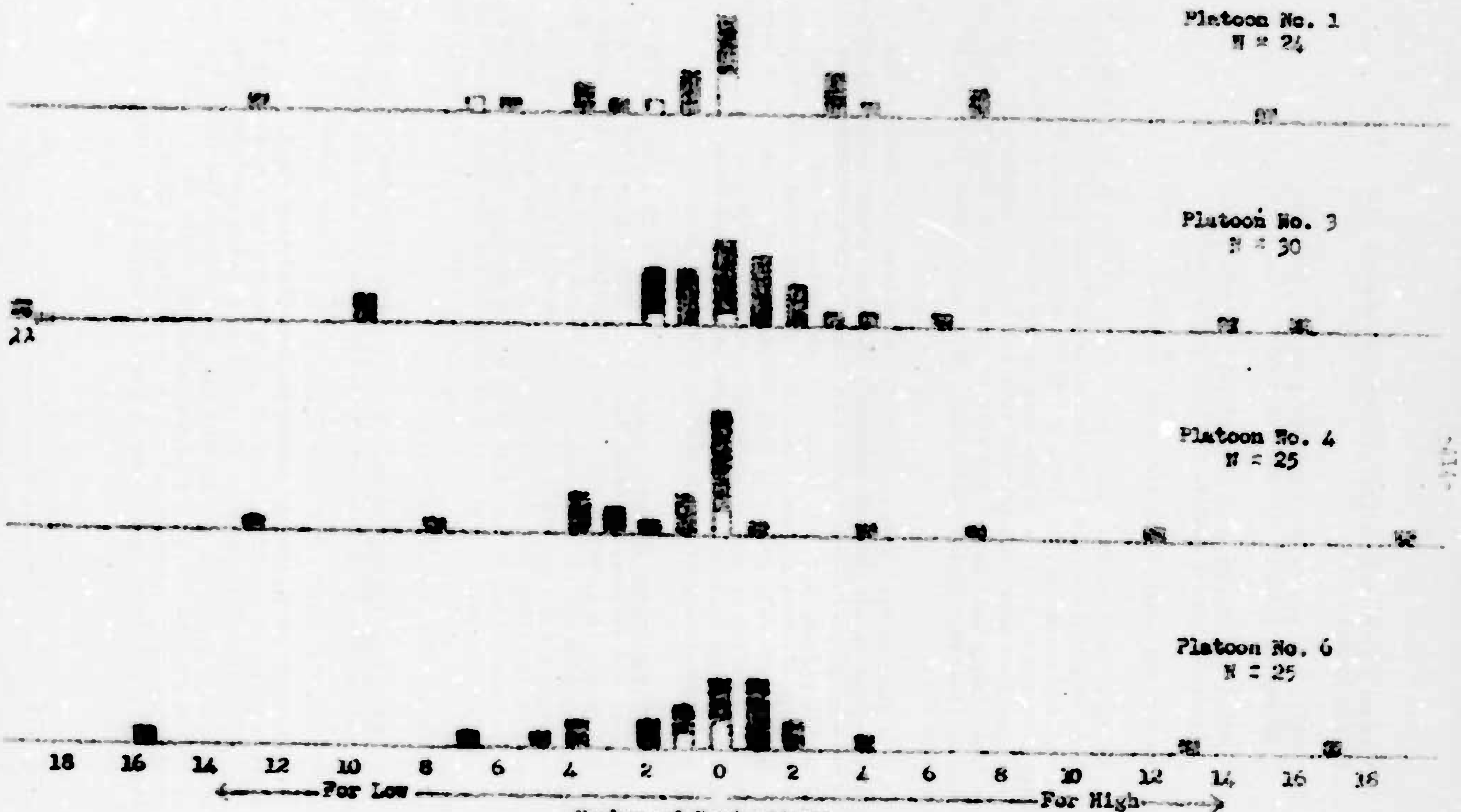

Figure 1

1 Case
1 Case with both high and low nominations. Score obtained by subtracting number of Low from number of High nominations.

the short paragraphs given by the respondents were broken down into elements, and these elements were combined into groups of items of similar psychological nature. The analysis was made separately for the high and low reasons and in so far as possible, independently of the combat results to avoid reading unjustified interpretations into the cadets' statements. The ten categories (plus a miscellaneous one) derived from this analysis are shown in Table I, and Figure 2 shows the relative frequency with which the categories were used for the two extreme cases at either end of the scale in the four platoons.

Experience, intelligence and judgment, and social adeptness were most frequently given as reasons for desiring other men as leaders of platoons. Lack of social adeptness and of responsibility and dependability were most frequently mentioned as reasons for not wanting the extreme cases as leaders. Although experience was frequently cited as a reason for wanting a man as a leader, inexperience was seldom mentioned as a reason for not wanting a cadet.

The cadets agreed remarkably well in the statements they made about a number of the extreme cases. Reasons given by the 16 cadets who nominated No. 11 in Platoon 6 are quoted verbatim in Table II. Figure 3 shows the placement of these statements in the categories.

Agreement Between Nominations and Officer Aptitude Ratings. -- Although the nominating technique tends to throw the extremes farther out on the scale than do the officer ratings, the agreement between officer aptitude ratings[2] and student nominations was substantial for each platoon. Figure 4 shows this relationship in graphical form for Platoon 3.

On the other hand, this agreement was not perfect. For example, Cadet No. 9 in the platoon illustrated received by far the largest number of choices by the cadets for the Low group; yet he was tied for sixth place (from the bottom) in terms of officer aptitude ratings. Discrepancies of this sort also occurred in the other platoons. Further study of cases of this type would seem to be warranted.

V. Summary and Discussions:

The nominating technique used for obtaining criterion groups in combat was adapted for use in the pre-flight situation to identify cadets showing desirable and undesirable leadership and associated qualities to an exceptional extent. Men nominated for the LOW group were characterized as showing poor judgment, social ineptness, lack of self-confidence, irresponsibility, undependability, uncooperativeness and certain other traits; and conversely, men identified as HIGH were characterized by the opposite terms. Superficially at least, these traits are similar to many of those mentioned by combat-experienced pilots in their reasons for wanting and not wanting other pilots as their wingmen in combat. They are also quite similar to the traits listed in the recent instructions from CNAPT for rating officer aptitude.

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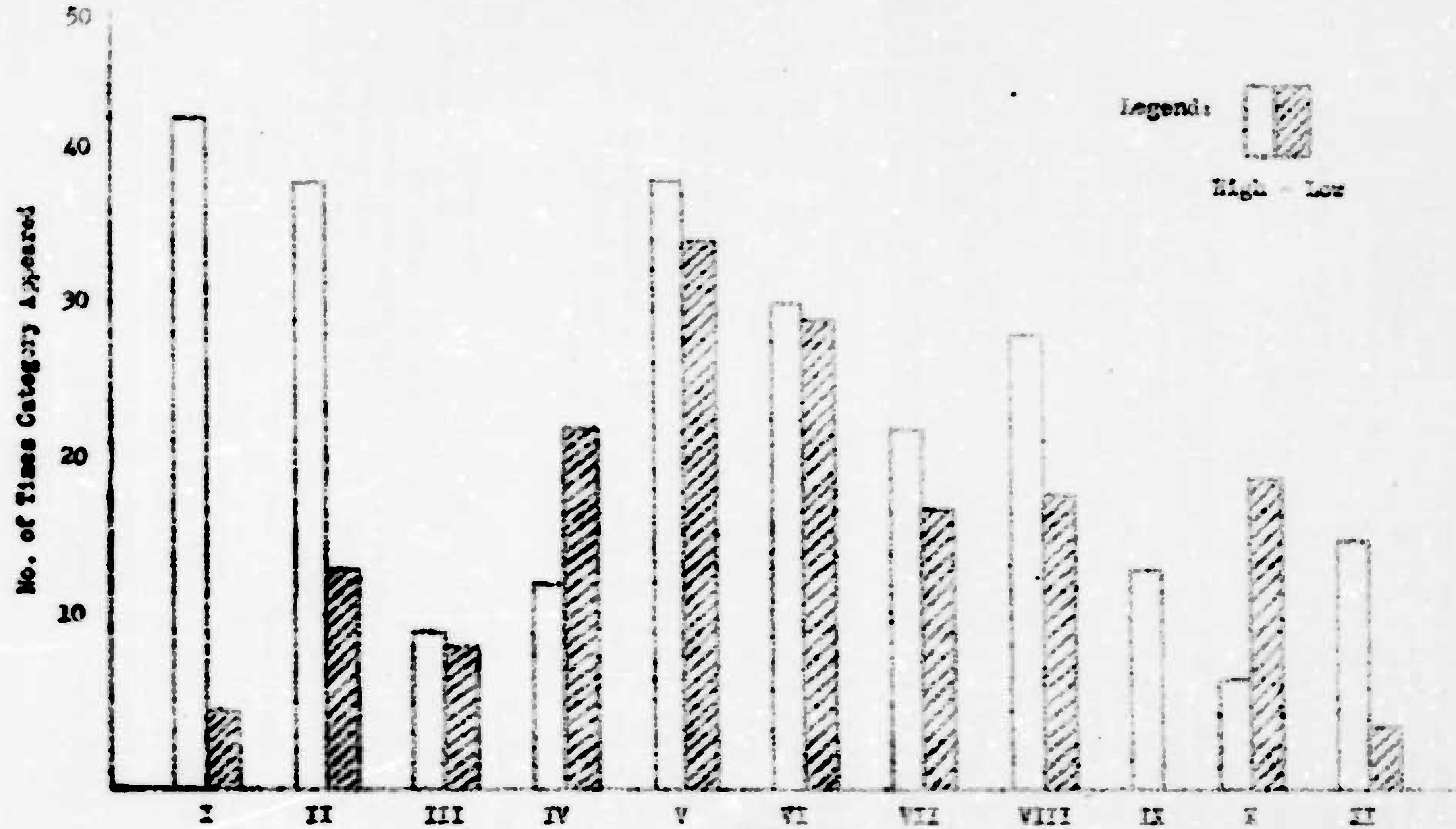
[2]Made according to the recent directive from CNAPT. Nine ratings were totaled for these comparisons.



Category
(Roman numbers correspond to category numbers in Table I)

Figure 2
Frequency of Use of High and Low Categories
(Based upon 269 high unit reasons given by 120 respondents and 177 low unit reasons given by 106 respondents for the two extreme cases in each platoon.)

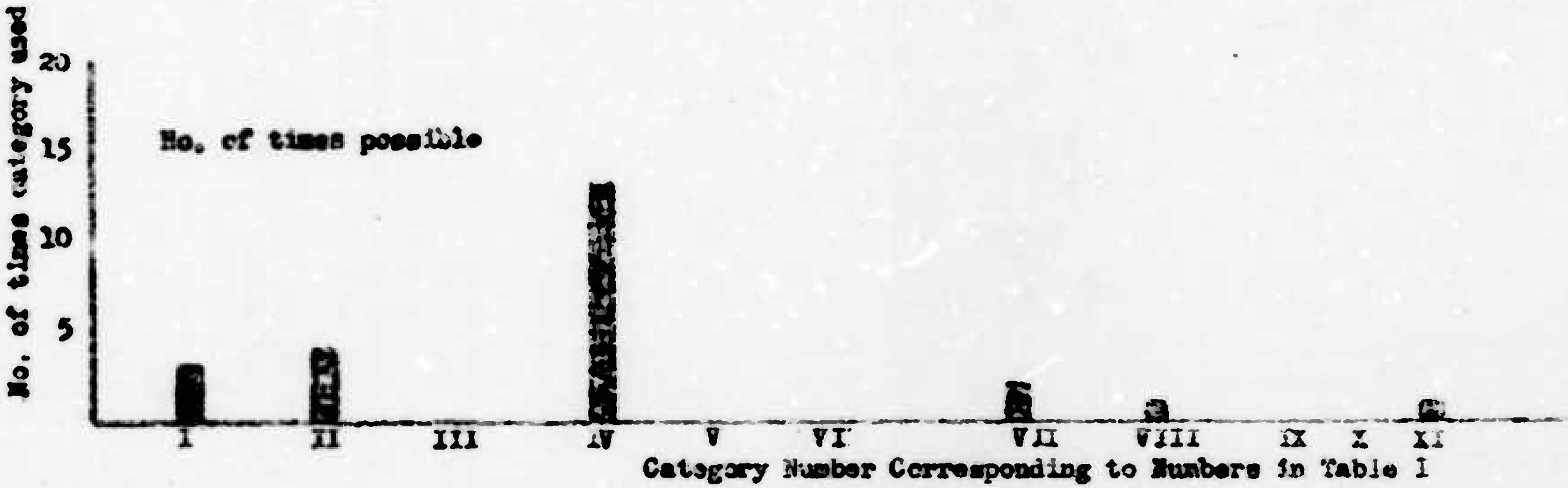


Figure 3.-- Frequency of Use of Categories for Cadet No. 11, Platoon 6, By the 16 Cadets Who Nominated Him.

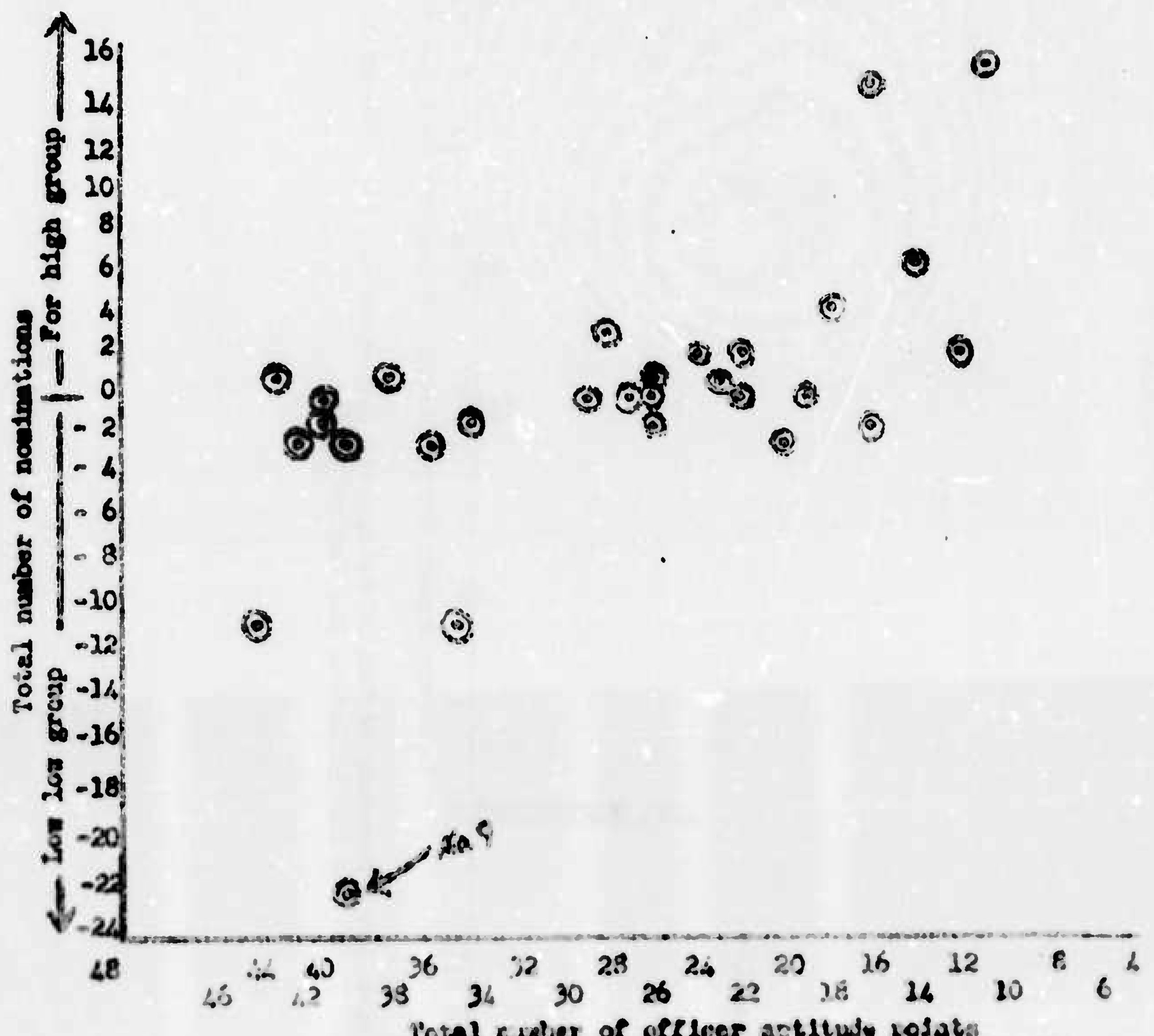


Figure 4 -- Relationship Between Officer Aptitude Ratings and Number of Nominations, All Cases in Platoon 3

TABLE I

HIGH AND LOW CATEGORIES

Question I

I Experience

Experience; background; maturity; knowledge of Naval Service; ability to do what others under him would have to do; service overseas.	Lacks experience.

II INTELLIGENCE, JUDGMENT

Good judgment; superior intelligence; alert; considers problems carefully; reacts rapidly with precision; good organizer.	Poor judgment; not sharp; can't organize; makes too many mistakes; slow in reacting.

III ATHLETIC ABILITY

Athletic ability good; athletic type.	Poor athlete; lacks stamina; poor coordination; lack of skill.

IV SELF-ASSURANCE, COURAGE

Has confidence in his own ability; forceful; self-controlled; not afraid to do what he thinks is right.	Lacks aggressiveness; no guts; shy; lacks poise; on excused squad most of time; feminine; lacks competitive spirit; lacks initiative; nervous in tight spots; not forceful.

V SOCIAL ADEPTNESS

Considerate; fair; reasonable; all around ability to get along with others; sense of humor; good sport; can give orders without being disliked; would not take advantage of authority.	Can't get along with others; too boisterous; displays partiality; lets authority go to his head; overuses authority; chronic griper; causes ill feeling; chides others; soft soaper; apple polisher; sullen; hot tempered; lacks sense of humor; holds grudges; cynical.

VI RESPONSIBILITY, DEPENDABILITY

A conscientious person; not a shirker; hard worker; accepts responsibility; serious in whatever he does; will do more than his part; dependable; would work hard whether	Not serious; doesn't take responsibility; shirks duty; sloppy in performance of his duty; haphazard in things he undertakes;

watched or not; would perform his duties properly.

careless; very erratic; not dependable; attitude good in presence of officers but changes completely when he gets off among his shipmates.

VII RESPECT OF OTHERS

Commands respect; men respect him; can get men to work.

Doesn't command respect; can't get cooperation.

VIII PROFICIENCY IN MILITARY ARTS

Gives commands well; good military bearing; good drill leader; easy to follow; marches well; good cadence.

Military bearing is poor; posture poor; sets poor example in ranks; poor at giving commands; poor in marching.

IX MOTIVATION

Interested in program; has initiative; perserverance.

X COOPERATIVENESS

Cooperative; obeys commands given by his superiors.

All out for himself; not loyal to Naval Service; not loyal to program; too independent; poor sportsmanship; jealous; grandstand player; uncooperative; lacks respect for other men in ranks: superior attitude; double crosser; doesn't obey orders willingly.

XI MISCELLANEOUS

Good morals; quick to think in emergencies; honest; frank.

Immature.

TABLE II

REASONS GIVEN FOR NOMINATING CADET NO. 11, PLATOON NO. 6, FOR LOW

"He becomes very unnerved and excited when in charge of the platoon. He also becomes very excited when taking tests."

"Nervous -- to a pronounced degree -- easily influenced by other cadets whether right or wrong."

"Too nervous and high strung. Complete lack of leadership."

"Lack of knowledge of military organization, and ability to drill platoon."

"Becomes 'rattled' easily -- lacks confidence."

"He hasn't the ability to lead men or to give orders effectively or to have the men's respect. Becomes frustrated and nervous at the wrong times."

"Not a very good leader of men, uses poor judgment often in handling men, military bearing only fair."

"He is not forceful enough, lacks self assurance, and experience in leading a platoon of men."

"He is too nervous and makes mistakes often. Though he is anxious to do well, he doesn't seem to have the ability."

"Not sure of himself. Not a leader. Has no good common horse sense."

"Seems to have little confidence in himself. Gets extremely nervous and doesn't know what to do when put under pressure."

"He lacks confidence in his ability and as a result not sure of what to do."

"Very slow in reacting to any circumstances which might come up. Doesn't have confidence."

"He is too easily 'rattled'. Very high strung or just plain nervous. Men would not be too willing about following him."

"He does not seem to have the qualities of a leader. He seems nervous and ill at ease when in charge of a group."

"His actions are too childish. Thus he does not command the men's respect.

Members of a platoon tended to single out one or two men as exceptionally outstanding and one or two men as least desirable. They also tended to agree in their statements about those men, and with the platoon and company officers in their ratings. However, cadets who received the most nominations for the HIGH and LOW groups were frequently not the extremes in officer aptitude points, and some method should be employed to reconcile these discrepancies.

At the present, the lowest five per cent of a battalion in terms of officer aptitude points at the end of pre-flight training, are called before the Commanding Officer's Advisory Board for consideration. It might also be desirable for the COAB's to review the officer qualifications of cadets who receive a large number of low nominations from other members of their platoons, and perhaps to forward favorable statements about the exceptionally high cadets to the next stage of training.

It should be emphasized, however, that the research nature of the present study was carefully explained in all relationships with the cadets, and that operation of the procedure should be scrutinized critically if it is introduced as a basis for administrative action. It should also be noted that the technique is primarily useful for identifying extremes and not for assigning scores to the "middle" group and that results with Question I (Appendix II) might not be duplicated with other questions.

APPENDIX I TO APPENDIX 8-B (THE ATHENS STUDY)

QUESTIONS USED IN PRELIMINARY TRY-OUT

1. Assume that it should prove necessary to throw your platoon or company into the front lines as ground troops to meet an enemy attack:

   x. Of all the men in your platoon or company, what two would you most like to see appointed as officers to organize your defense and to lead you in battle? Why?

   y. Which two least? Why?

2. Assume that sides are being chosen up for a new game in which athletic skill is of little importance but where team play is utterly essential:

   x. Which two men in your platoon or company would you try hardest to get for your side? Why?

   y. Which two men would you be glad to see the other side get? Why?

3. x. What two men do you think have contributed most to the over-all success of your platoon here in Pre-Flight School? How have they made their contributions?

   y. What two men do you think have contributed least to the over-all success of your platoon here in Pre-Flight School? For what reasons do you choose them?

4. Assume that you were accused of some offense of which you were not entirely guilty:

   x. What two men in your platoon or company would be most likely to assist you even though helping you might cast reflection upon them? What have they done which causes you to choose them?

   y. What two men in your platoon or company would be least likely to attempt to assist you if they thought they might get into trouble by doing so? For what reason do you name these two men?

5. x. Which two men have shown themselves, on the athletic field, most willing to accept criticisms and suggestions? How has willingness to accept criticisms and suggestions shown itself in these men?

   y. Which two men have been most inclined on the athletic field to insist on their own way of doing things, i.e., men who tend to reject criticisms and suggestions?

6. Assume you are in charge of a Cadet Platoon or company. A dispatch arrives, directing you to appoint two men to carry out an important mission, which will require sound judgment, willingness to accept responsibility, and ability to reach sound decisions quickly:

   x. What two men of your platoon or company are your most likely selections? How have these men demonstrated those qualities that would be required?

   y. What two men are your least likely selections? Why?

7. Assume you were asked to choose two men as roommates:

   x. What two men in your platoon or company would you choose?

   y. What two men would you definitely not want? Reason?

8. If the Secretary of Navy were to order a 50% reduction in the flight training program?

   x. What two men in your platoon or company do you think should be eliminated first? For what reason do you name these two men?

   y. What two men do you think should be retained by all means? For what reasons do you name these two men?

9. x. In your estimation what two men in your platoon or company are most anxious to fly? How have these two men demonstrated their interest?

   y. What two men in your platoon or company are least anxious to fly? How have these men shown their lack of interest?

APPENDIX II TO APPENDIX 8-B (THE ATHENS STUDY)

CADET PERSONALITY EVALUATION

Your name____ Service No. ________
Last First Middle

Battalion______________ Company ____________ Platoon ____________

Date ____________________ No. of weeks on board ________ Age ______

Rate ____________ Service ________ Mos. of duty _____ Engagements __

____

____

____

INTRODUCTION

We are trying to determine whether or not cadets can make satisfactory judgments of other cadets. The ability to make honest, frank, and objective judgments of people is one mark of a good officer. By the term "objective judgments" is meant judgments free from bias or prejudice. You will often be called upon to exercise this ability as an officer, in making assignments, in completing fitness reports, or in grading if you are detailed as an instructor.

On the following pages are three questions designed to obtain your evaluation of other members of your platoon. Be sure to answer all the questions. You may nominate the same man more than once. Your answers will be treated as confidential and will be used for research purposes only. The answers will not be shown to any other men in the platoon or detachment and will not be used as a basis for eliminating or retaining men in flight training. You are asked not to discuss your answers with anyone.

Let it be emphasized. The reason for this study is simply as stated: To find out whether or not cadets can make sound judgments of their fellow cadets.

I. Assume you were to organize a new platoon in Pre-Flight School:

A. What two men in your present platoon would you select as leaders for the new one?

1. ____
Last name Initials

For what reasons do you choose this man? ____________________

____

____

____

2. ____
Last name Initials

For what reasons do you choose this man? ____________________

____

____

____

B. What two men in your present platoon would you least desire as leaders of the new platoon?

1. ____
Last name Initials

For what reasons do you name this man? ____________________

____

____

____

2. ____
Last name Initials

For what reasons do you name this man? ____________________

____

____

____

II. Assume you are captain of a team for a new game in which athletic skill is of little importance?

A. Which two men in your present platoon would you try hardest to get?

1. ______________________________
Last name Initials

For what reasons do you want this man? ______________________

____

____

____

2. ______________________________
Last name Initials

For what reasons? ______________________________

____

____

____

B. Which two men would you be most willing to see the other side get?

1. ______________________________
Last name Initials

For what reasons? ______________________________

____

____

____

2. ______________________________
Last name Initials

For what reasons? ______________________________

____

____

____

III. Considering the Pre-Flight program as a whole (academics, athletics, and military):

A. What two men have made the greatest contribution to the over-all success of your platoon?

1. ______________________________________
Last name   Initials

In what ways has he made his contribution? ____________________

____

____

____

2. ______________________________________
Last name   Initials

In what ways has he made his contribution? ____________________

____

____

____

B. What two men have made the least contribution to the over-all success of your platoon?

1. ______________________________________
Last name   Initials

For what reasons do you choose him? ____________________

____

____

____

2. ______________________________________
Last name   Initials

For what reasons do you choose him? ____________________

____

____

____

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